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JOURNAL
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STUDIES IN THE BORAGINACEAE, XX
REPRESENTATIVES OF THREE SUBFAMILIES IN EASTERN ASIA

IVAN M. JOHNSTON

PRESENTED HERE is an account of the Cordioideae, Ehretioideae and Heliotropioideae known from China, northern Indo-China, Hainan, Formosa, Ryukyus, and Japan. The classification of the larger and much more complex Boraginoideae will be treated in subsequent papers. The groups here treated are the more primitive ones of the family and are chiefly trees and shrubs. They are well represented in the herbarium of the Arnold Arboretum. My study has been based primarily on that collection. Very valuable in clarifying many details, however, have been specimens made available to me at the Gray Herbarium and the New York Botanical Garden.

KEY TO THE SUBFAMILIES AND GENERA

Style twice forked, the four ultimate branches each bearing a stigma; cotyledons plicate; endosperm absent. CORDIOIDEAE.....1. *Cordia.*
Style simple or simply forked or divided; stigmas 1 or 2; cotyledons not plicate.
  Style arising from the fruit and seated terminally in its pericarp, falling away with it; endosperm usually present though often scanty.
    Stigmas usually 2, small, capitate or elongate or rarely subpeltate, not differentiated into receptive and sterile tissue; style usually lobed or parted. EHRETIOIDEAE.
      Fruit dry, breaking up into bony nutlets; herbs..2. *Coldenia.*
      Fruit drupaceous; shrubs or trees.
        Style simple, terminated by a small obscurely bilobed subpeltate stigma; endocarp strongly lobed.....3. *Rotula.*
    Style evidently lobed or even nearly divided; stigmas 2.
      Style almost divided, forking well below middle; endocarp of mature fruit remaining entire, ovoid.....4. *Carmona.*
      Style forked above the middle; endocarp of mature fruit dividing into single-seeded or 2-seeded pyrenes.....5. *Ehretia.*

Stigma single, partially sterile, conic or frustrum-like or rarely peltate, stigmatic only in an obvious sharply delimited and usually tumid circumferential band at base, or rarely irregularly globose and broadly and somewhat indefinitely stigmatic laterally but sterile at the apex; sterile portion of stigma frequently somewhat bilobed; style simple or none. HELIOTROPIOIDEAE.

Fruit at maturity without a clearly differentiated, well-developed mesocarp, dry, the bony endocarp covered only by a thin layer of epicarp; herbs and suffrutescent plants.....6. *Heliotropium.*

Fruit at maturity with an evident well-developed mesocarp; mostly shrubs and trees.

Mesocarp very juicy, soft and watery, shrinking greatly or even disappearing in drying; chiefly scandent shrubs....7. *Tournefortia.*

Mesocarp vesicular, forming permanent firm corky tissue about the endocarp; herbs, shrubs, and trees:.....8. *Messerschmidia.*

Style not borne directly on the fruit, seated independently at the middle of the floral receptacle or on a central upward projection of the receptacle (gynobase) and arising between the lobes of the dry fruit (nutlets) and free from them; style simple; stigma simple or rarely 2-lobed; endosperm absent; mostly herbs. BORAGINOIDEAE.

1. CORDIA L.

Cordia L., Sp. Pl. 190 (1753) and Gen. Pl. 87 (1754).

Trees or shrubs; leaves small to large, usually evidently petiolate, margin entire, crenate, serrate or rarely even lobulate; cymes ebracteate, mostly corymbose; flowers homomorphous or heterostyled or functionally more or less unisexual (functionally male flowers with style and stigmas much reduced or completely undeveloped); corolla campanulate to funnelform, small to large, white, yellow, orange or red, usually 5-merous but occasionally 4–8-merous, lobes ascending to recurved, tube short to long, cylindric or expanding; stamens exserted or included, filaments often hairy towards the base, usually well developed; style terminal on ovary, dichotomous, a simple column at base, then dividing into two branches which in turn fork to produce the four ultimate branches each bearing a stigma; stigmas 4, clavate to spathulate or capitate; fruit a drupe with watery or glutinous mesocarp or rarely without fleshy mesocarp and hence a nut; endocarp bony, 1–4-seeded; seeds without endosperm; cotyledons plicate.

A large group of tropical trees and shrubs having the majority of its species and its center of greatest diversity in America. With the sole exception of *C. subcordata*, all the Old World species belong to the section *Myxa*. It is now clear that a large number of American species, those treated in my previous writings as belonging to the section *Pilicordia*, also belong in the section *Myxa*. The section, accordingly, is now recognized as the largest and most widely represented in the genus. With so many species and with representatives in so many floras involved it would

be unfortunate to have this large section disassociated from the genus *Cordia*. This is a possibility if the genus continues to be typified by *C. Sebestena*. The substitution of *C. Myxa* as genotype should be considered.

The generic name *Cordia* was historically first associated with *Cordia Sebestena*, and Linnaeus gave every evidence of building his generic concept around that species, cf. Johnston, Contr. Gray Herb. **92**: 41 (1930) and Jour. Arnold Arb. **16**: 4 (1935); and Hitchcock and Greene, Proposals Brit. Botanists, Intern. Bot. Cong. Cambridge p. 133 (1929). Logic may demand that *C. Sebestena* be accepted as genotype, but I have come to realize the possible effects, and now believe logic should yield to expediency. *Cordia Sebestena* is one of a small group of mainly West Indian species, certainly aberrant in *Cordia* as a whole, which has been and probably should be treated as generically distinct. I am not prepared to have the name *Cordia* restricted to the few relatives of *C. Sebestena*. It seems best to have *C. Myxa* declared the genotype of *Cordia* and so guarantee the continued wide application of the epithet. In justification of this it can be pointed out that among the three species of *Cordia* treated in the Species Plantarum of 1753, *Cordia Myxa* was the first treated and the only officinal plant, and it certainly was the best known to Linnaeus and his contemporaries.

Key to the Species

Flowers large, orange, over 3 cm. long; fruit with corky mesocarp, developing completely and tightly enclosed by the enlarged coriaceous calyx. § *Sebestena*.....1. *C. subcordata.*

Flowers small, white, 6–16 mm. long; fruit a drupe with watery or viscous mesocarp, supported at base by a small, weakly accrescent, usually explanate calyx. § *Myxa.*

Calyx strongly 10-ribbed; flowers heterostylic. style developed in all flowers; Formosa.....2. *C. Kanehirai.*

Calyx not strongly ribbed; flowers either hermaphroditic or male; no style developed in the male flowers.

Lateral inflorescences extra-axillary; corolla 7–9 mm. long; ultimate style-branches 2 mm. long.....3. *C. furcans.*

Lateral inflorescences terminal on short leafy axillary twigs.

Inflorescence loose; corolla 8–10 mm. long; ultimate style-branches 3–5 mm. long.....4. *C. dichotoma.*

Inflorescence narrow and congested; corolla 14–16 mm. long; ultimate style-branches 5.5–6 mm. long.....5. *C. cochinchinensis.*

1. **Cordia subcordata** Lam., Tab. Encyc. 1: 421 (1891); Poir., Encyc. 7: 41 (1806); Clarke, Fl. Brit. India 4: 140 (1883): Gagnep. & Cour., Fl. Indo-Chine 4: 204 (1914) — "ex insulis Praliniis," *Commerson.*

Cordia orientalis R. Br., Prodr. 498 (1810) — type from Australia.

Cordia campanulata Roxb., Hort. Bengal 17 (1814) and Fl. Indica, ed. Car. & Wall. **2**: 332 and 336 (1824) — type from India.

Cordia Rumphii Blume, Bijdr. **14:** 843 (1826); Merrill, Interp. Rumph. Herb. Amboin. 447 (1917) — "in insulis Moluccanis."

Cordia muluccana Roxb., Fl. Indica, ed. Car. & Wall. **2:** 337 (1824); Hallier, Meded. R. Herb. Leiden **36:** 3 (1918) — "native of the Moluccas."

Cordia hexandra R. & S., Syst. **4:** 799 (1819) — type from India.

Tree 2–15 m. tall; leaves ovate to elliptic, firm, 8–20 cm. long, 5–15 cm. broad, with petiole 2–8 cm. long, margin entire (or toothed only on vigorous shoots), base obtuse to rounded or rarely subcordate, apex obtuse to rounded or rarely acute, short-acuminate, upper surface somewhat lustrous bearing minute inconspicuous very scattered short appressed hairs, in age frequently dotted with groups of mineralized epidermal cells, under surface more or less villulose or even tomentulose along the midrib and principal veins; inflorescence terminal, loose, cymose, 6–20-flowered, usually becoming oppositifolious and nodding at maturity, without the flowers 2–5 cm. long and 1–3 cm. broad, peduncle 0.5–2 cm. long; calyx at anthesis coriaceous, smooth, cylindric or slightly ampliate, 10–20 mm. long 4–8 mm. thick, glabrous or sparingly strigose, pedicel 0.2–1 cm. long; calyx after anthesis accrescent with the tube greatly distended by the enlarging fruit which it tightly and completely encloses, green or becoming somewhat yellowish at maturity; corolla large, conspicuous, funnelform, orange, 3.5–5 cm. long, with limb nearly as broad, lobes 5–7, broad, rounded, spreading; filaments attached above middle (about 17 mm. above base) of the flaring corolla-tube; style 23–30 mm. long; fruit dry, a nut (not a drupe), ovoid or obovoid or subglobular, 15–25 mm. thick, 20–30 mm. long, developing tightly and completely invested by the coriaceous calyx-tube, at extreme maturity by slight shrinkage of the corky mesocarp becoming loosened within the now hardened and somewhat woody calyx and only by chance destruction of the latter freed from it; endocarp bony, angular, much ridged and roughened, containing 4 ovuliferous cavities and a central sterile one, commonly maturing only 1–2 seeds; mesocarp firm, corky, permanently surrounding the rough endocarp and giving the fruit its rounded contours, dry at maturity.

Hainan; Indo-China to India and southward through the East Indies; also on the islands of the South Pacific, on the islands of the Indian Ocean, and along the east coast of Africa; a plant of tropical coasts having a fruit suitable for dissemination by ocean currents.

HAINAN: Yaichow, Yu-lum Harbor, seashore, *C. Wang 34802* (A, NY).

A well-known and widely distributed strand-tree having fruit buoyed and protected by a tough corky mesocarp, well adapted for dissemination by ocean currents. It belongs to the section *Sebestena,* a very well marked group of species. Except for *C. subcordata,* all are confined to the West Indies, where several are local endemics in the Greater Antilles and only *C. Sebestena* has a wide occurrence as a wild tree. None of these American relatives are ocean-disseminated. *Cordia subcordata,* indeed, appears to be the only one so dispersed in the whole of *Cordia.*

The species is probably heterostylic. In some flowers the filaments are only 3 mm. long and support anthers 2–2.5 mm. long, while others have filaments two to three times as long, as well as anthers up to 3.5 mm. in length. The flowers with short stamens are associated with styles 27–30 mm. long, while those with longer stamens have styles 22–25 mm. in length. Heterostyly occurs in the American members of the section *Sebestena*. Field observations are needed to determine how general and how marked it may be in this Old World relative.

2. **Cordia Kanehirai** Hayata, Icon. Pl. Formosa 6: 31 (1916); Kanehira, Formosan Trees 634, f. 591 (1936) — type from Kuraru, Koshun, Formosa, *Kanehira 7*.

Small tree; branches dichotomous, terete, with a short brownish appressed pubescence when young, later glabrescent; leaves lanceolate, broadest below middle, 8–14 cm. long, 2.5–5 cm. broad, with scattered minute appressed hairs especially when young, glabrescent in age, apex acute to slenderly acuminate, base broadly acute or rounded, with petiole 1.5–3 cm. long, margin entire or remotely and inconspicuously serrate, primary veins 5–6 on either side of the midrib, secondary and tertiary veins not conspicuous; inflorescence loosely cymose, 3–6 cm. broad, borne terminal between the diverging branches of the dichotomous stem or borne lateral and internodal; calyx densely brownish strigose, cylindric, 10-ribbed, 4–5 mm. long, with 5 small acute teeth; corolla white, lobes verrucose on upper surface, elongate, about as long as the tube; stamens attached above middle of tube, not much exserted; drupe probably white, erect, ellipsoidal, about 12 mm. long, supported by a cupulate calyx which becomes about 8 mm. in diameter; endocarp elongate, irregularly roughened by coarse ridges and tuberculations.

Known only from southern Formosa.

FORMOSA: Kôshun, Kuraru, Jan. 8, 1914, *Kanehira 7* (ISOTYPE, A).

According to Kanehira, l.c., the plant is "known only from Kural, Kôsyun Peninsula" at the south end of Formosa, where it is "very scarce." It belongs to a closely interrelated group of species containing *C. aspera* Forst. of Polynesia, *C. micronesica* Kanehira & Hatusima of Palau, and *C. Cumingiana* Vidal of the Philippines. Judging only from the type collection, *C. Kanehirai* may be readily distinguished by its lanceolate glabrescent leaves and elongate endocarps. I have seen only very immature corollas. No doubt it, like its immediate relatives, has heterostylic flowers that function as either male or female. The style developed in the male flowers is only half the size of that in the female. As regards the size of stamens just the reverse condition is true. Functionally the trees are unisexual and the species dioecious. The strongest relations of the *C. aspera* group appear to be with species of Central America.

3. **Cordia furcans,** sp. nov.

Arbor 3–15 m. alta; foliis ovatis vel ellipticis 5–17(–25) cm. longis, 4–12(–20) cm. latis graciliter 3–8 cm. longeque petiolatis, basi saepissime

obtusis vel rotundis, rare acutis vel subcordatis, apice obtusis non rariter plus minusve breviter lateque acuminatis, margine integris vel rariter obscure crenatis, supra saepe pilis minutis rigidulis adpressis plus minusve donatis (pilis e basi subbulbosa vel discoidea maturitate saepe pallida orientibus), subtus juventate pilis pallidis vel fulvescentibus mollibus non rariter abundantibus donatis tomentosis vel velutinis vel puberulentis, maturitate plus minusve glabratis sed non rariter velutinis, costa cum nerviis in facie inferiori folii prominentibus, in facie superiori leviter convexa; venis primariis majoribus utroque latere costae 3–5 fere rectis; inflorescentia terminali vel internodali laxe dichotomeque cymosa 2–20 cm. diametro 2–8 cm. longe pedunculata; floribus dimorphis 4–5-meris; calyce sessili vel subsessili in alabastro obovoideo saepissime haud apiculato juventate plus minusve fulvo-tomentoso vel subglabro, sub anthesi campanulato 4–6 mm. longo, lobis inaequalibus recurvatis 1–1.5 mm. longis; corolla alba 7–9 mm. longa, lobis 3.5–5 mm. longis oblongis recurvatis, tubo 3.5–4 mm. longo gradatim ampliato basi 1–1.5 mm. crasso apice 2–2.5 mm. crasso; filamentis sparse villosis apicem versus tubi affixis, eis floris masculini 3.5–5 mm. longis (antheris 2–2.5 mm. longis), eis floris hermaphroditi 1–1.5 mm. longis (antheris 0.5–0.8 mm. longis); ovario glabro globoso; stylo floris masculini nullo, floris hermaphroditi 4 mm. longo, columna basali 4 mm. longa, ramulis primariis 0.5 mm. longis, ramulis ultimis stigmatiferis 2 mm. longis valde compressis anguste oblanceolatis margine plus minusve lobulatis; drupa rubra vel rosea, erecta crasse ellipsoidea, calyce cupulata irregulariter lobata 5–8 mm. diametro glabro vel puberulento suffulto.

Southern China (so. Yunnan and Kwangsi), Hainan and south into Burma, Indo-China, and northern Siam.

YUNNAN: Ho-kou, alt. 1700 m., *H. T. Tsai 52656* (A); Sheau-meng-yeang, Che-li Hsien, *C. W. Wang 79199* (A); Meng-nün, Jenn-yeh Hsien, 950 m., *C. W. Wang 79997* (A); Meng-him, Jenn-yeh Hsien, 800 m., *C. W. Wang 80063* (A); Meng-la, Jenn-yeh Hsien, 900 m., *C. W. Wang 80563* (A); Maan-tsang, Sheau-meng-yeang, Luh-shuen Hsien, 800 m., *C. W. Wang 81085* (A); Mienning, Matai, 1160 m., *T. T. Yü 18116* (A); Yuanchiang, 5000 ft., *Henry 13251* (A, TYPE; NY, ISOTYPE); Szemao, Namban Ho, 5000 ft., *Henry 13386* (A, NY).

KWANGSI: mountains near Pa Lau Village, near Sui-luk, southwest of Nanning, *W. T. Tsang 21808* (A).

HAINAN: Pak Shik Ling, *C. I. Lei 243* and *428* (A, NY); Ka Chik Shun, *S. K. Lau 1519* (A, NY) and *2855* (A); Chim Fung Ling, *S. K. Lau 3502* (A); I Kap Shan, *S. K. Lau 1028* (A, NY); Yaichow, *N. K. Chun & C. L. Tso 44708* (A, NY); without locality, *H. Y. Liang 63556* (A, NY), *C. Wang 36288* (A, NY) and *36351* (A, NY).

INDO-CHINA: Tonkin: betw. Dong Mo and Van Linh, prov. Langron, *Petelot 2104* (A, NY) and *2110* (A); vicinity of Dong Mo, *Petelot 6313* (A); Thank Moi, prov. Longron, *Petelot 6617* (A).

INDIA: Mainimukli, Kassalong River, Chittagong Hill Tract, *Parkinson 4254* (NY).

BURMA: Kabaing to Kegalpyin, Ruby Mines District, *Lace 5995* (A);

Pang Mah Ki Hat, Keng Tung Terr., Southeastern Shan States, *Rock 1956* (A).

SIAM: betw. Ban Tong Ha and Ta Kaw, *Rock 1701* (A); Chumpawn, Siep Yuan, *Kerr 16248* (A); Chieng Mai, *Kerr 6409* and *6462* (A); Kanburi, *Kerr 10222* and *10189* (A).

This species is related to *C. grandis* Roxb. and confused with that species by various recent authors, e.g. Fl. Indo-Chine 4: 202 (1914). That species, however, is a tree of Bengal, Assam, and adjacent Burma, and was based upon material from Chittagong. It differs from *C. furcans* in having only terminal, leafless inflorescences. These are very large and symmetrical and are borne at the ends of elongate leafy non-forking branches. In *C. furcans* the smaller asymmetric inflorescences are mostly lateral along the leafy branches, borne on short non-axillary branchlets. Leaves are frequently present on their lowermost branches. The inflorescence of *C. grandis*, accordingly, is not only larger but also projects out much more from the leafy mass of the plant. The leaves of that species are much less variable in outline than those of *C. furcans* and have a characteristic pointed and ovate contour. Its mature flower-buds are oblong-ovate and generally have a distinct, minute apical appendage. They are longer and proportionately more elongate than the plump, obovate, usually unappendaged buds of *C. furcans*. The drupes of *C. grandis* are described as "dirty yellowish." Those of *C. furcans* are stated by collectors to be red or pink.

The name *Cordia Clarkei* Brace ex Prain, Bengal Pl. 713–14 (1903), has also been applied to the present plant. Handel-Mazzetti, Symb. Sin. 7: 814 (1936) so reports a collection (*H.-M. 5960*) from between Mengtse and Hokow, southern Yunnan, said to be the same as collections of *Henry* (nos. *13251* and *13386*) from the same region. A collection from Lungdschou, Kwangsi, *Morse 414*, is also listed. For all practical purposes, though unhappily not legally, *Cordia Clarkei* is a *nomen subnudum*. For nearly a half-century it still remains known in botanical literature chiefly from a few odd bits of ambiguous information contained in a brief superficial key to the Bengal species of *Cordia*. It was said to grow in East Bengal and Chittagong, but no type was designated nor any other representative collections listed. Brandis, Indian Trees 479 and 714 (1906), alludes to *C. Clarkei* and suggests it as possibly conspecific with our plant from Yunnan. *Henry 414* was cited along with collections from Assam and Bengal. Whether or not Brandis had true *C. Clarkei* is uncertain, however. His few notes could apply to a very hairy form of *C. grandis*. Indeed, *C. Clarkei* may be such a plant.

From *C. Myxa* and its relatives *C. furcans* can be distinguished not only by the less prominent vein-reticulum on the lower leaf surface, but also by the extra-axillary rather than axillary origin of its lateral inflorescences. The origin of the lateral inflorescences in our species is the result of true stem-dichotomy. Among American species stem-dichotomies, or even trichotomies, are frequent and can be very regular and even delimit stem-sections associated with very marked heterophylly, cf.

Johnston, Sargentia 8: 256 and 258 (1949). Among Asiatic species regular symmetrical dichotomy is displayed only by *C. Kanehirai* of Formosa and *C. Cumingiana* of the Philippines. In *C. furcans* it is irregular, and the branches at each fork are unequal. At the fork one branch bears the lateral inflorescence and one to few leaves, while the other continues as part of the axis of the main shoot. The inflorescences, accordingly, appear to arise at any point in an internode along the main shoot. Only by chance do they arise near the leaf-axil or on the shoot opposite them. Indeed, when by chance they happen to be close to a leaf-axil, they tend to be somewhat lateral to it. Possibly there may be some vague tendency for heterophylly associated with this shoot system. In American species leaves of distinctive form may be repeated along the elongate shoot and always with a precise phyllotactic relation to the point on the stem where dichotomy occurs or is latent. Along sections of the dichotomizing stem of *C. furcans* the leaves show somewhat more than usual variation in size and proportional length of petiole, but if this has any phyllotactic relation it has eluded me. The matter is best investigated by one who has a supply of fresh vigorous shoots available. An analysis of this shoot system would be interesting.

4. **Cordia dichotoma** Forster f., Prodr. 18 (1786); Kanehira, Formosan Trees 633, f. 590 (1936); Chen Yung, Illus. Man. Chin. Trees 1038, fig. (1937); W. R. Brown, Useful Pl. Philippines 3: 268, f. 103 (1946) — type from New Caledonia.

Varronia sinensis Loureiro, Pl. Cochinch. 138 (1790); Merrill, Trans. Am. Philos. Soc. n.s. **24**[2]**:** 329 (1935) — "Habitat in variis locis imperii Sinensis."

Cordia Loureiri R. & S., Syst. **4:** 466 (1819) — based on *Varronia sinensis* Lour. non *Cordia sinensis* Lam.

?Argyreia arborea Loureiro, Fl. Cochinch. 135 (1790); Merrill, Trans. Am. Philos. Soc. n.s. **24**[2]**:** 329 (1935) — "Habitat in sylvis, et colitur in hortis tam in Cochinchina, quam in China."

Cordia suaveolens Blume, Bijdr. **14:** 843 (1826) — type from western Java.

Cordia indica Lam., Tab. Encyc. **1:** 422 (1791); Poir., Encyc. **7:** 49 (1806) — type from East Indies, *Sonnerat.*

Cordia Brownii DC., Prodr. **9:** 499 (1845) — type from tropical Australia.

Cordia ixiocarpa F. v. M., Frag. **1:** 59 (1858) — type from tropical Australia.

?Cordia Lowriana Brandis, Indian Trees 479 (1906) — type from India.

?Cordia crenata sensu Duthie, Fl. Upper Gangetic Pl. **2:** 83 (1911).

Tree 3–10 m. tall; leaves elliptic to ovate or obovate, not very thick, usually 8–12 cm. long and 4–8 cm. broad, apex obtuse or frequently also with a short usually obtusish acumen, base rounded to acute, margin entire or rarely somewhat repand or sinuate above the middle, upper surface sparingly puberulent, glabrescent, at times dotted with minute clusters of mineralized epidermal cells or minutely punctate or both, lower surface paler, puberulent, usually glabrescent, petiole slender, 2–4 cm. long;

inflorescence cymose, dichotomous, bractless, loosely branched, 3–8 cm. broad, borne on peduncle 1–3 cm. long, terminal on twigs which are usually 1–8 cm. long; fertile twigs producing only a few (2–5) leaves, and springing from the axils along the defoliated elongate sterile shoots of the previous season; flowers of two sorts, male and hermaphrodite, produced apparently on separate trees; MALE FLOWERS shorter than the hermaphrodite, similar in form or at times with a somewhat expanded corolla-tube, filaments 3.5–4.7 mm. long, sparingly hairy below the middle, attached just below the corolla-sinus, anthers 2–2.8 mm. long, ovary abortive, globose, glabrous, bearing a minute terminal papilla representing the undeveloped style; HERMAPHRODITE FLOWERS with calyx 5–6 mm. long, obovate in bud, not striate, campanulate, 4–6 mm. in diameter at summit, base rounded, sessile, lobes recurved, unequal, somewhat triangular, becoming dry and friable; corolla 8–10 mm. long, lobes recurving 5–6 mm. long, 2–2.5 mm. wide, tube 3–5 mm. long, usually shorter than lobes, hairy only below the stamen-attachment; filaments 1–2 mm. long, usually borne just below the corolla-sinus, sparingly hairy below the middle; anthers 2 mm. long; ovary glabrous, 2.5–3.5 mm. long, narrowed above the middle; style with basal column 1–1.5 mm. long, the first branch about 1 mm. long, the ultimate stigmatiferous branches 3–5 mm. long, flattened, broadened and usually minutely lobulate above the middle; drupe with viscous mesocarp, globose, 10–15 mm. in diameter, yellow or somewhat orange or reddish, supported by an accrescent indurate saucer-shaped calyx 8–12 mm. in diameter.

Southern China, Formosa, Hainan, and Indo-China, also from northern India to New Caledonia and northeastern Australia.

FUKIEN: Amoy, temple grounds, *H. H. Chung 4689* (A); Koo Long Ul, garden, *McClure 19236* (NY); Amoy, *H. H. Chung 4641, 4649,* and *5973* (A); Fukien, *Dunn 3356* (A).

HUPEH: Lokiashan, Wuchang, *S. C. Sun 116* (NY).

KWANGSI: Hin Yen, *R. C. Ching 6788* (NY).

KWANGTUNG: Canton, *Levine 2081* (A); Ting Woo Shan, Kao-Yao District, riverbank, *S. K. Lau 20267* (A, NY); Ho Yuen, *C. L. Tso 21512* (NY); Lau Lung, Lungchun, *C. L. Tso 21667* (NY).

YUNNAN: Chen Kang Hsien, *C. W. Wang 72851* (A); Fo-Hai, *C. W. Wang 74065, 74265, 74738,* and *77093* (A); Hei-lung-tarn, Fo-hai Hsien, *C. W. Wang 76292* (A).

FORMOSA: Hokuto, *Faurie 1835* (A); Taihoku, *Tanaka 99* (A); Taihoku, *S. Sasaki 206* (A); Takow, *Henry s.n.* (A, NY); Sanzyuko, Taihoku, *Y. Simada 5880* (A); without locality, *Oldham 350* (G).

HAINAN: Ka La, *McClure 9198* (A); Lin Fa Shan, *T. T. Tsang 8, 332,* and *468* (A); Sha Po Shan, *W. T. Tsang 563* (A, NY); Yaichow, *H. Y. Liang 62545* (A); Po-ting, Lingshin, *H. Y. Liang 61583* (A, NY); Yaichow, *F. C. How 70876* (A, NY); Manning, *F. C. How 71349* (A); Hung Mo Shan Tsang, *Tang and Fung 70* (A, NY); Fan Ya, *McClure 9639* (NY); without locality, *Levine 870* (A).

The plant I have described is that found in China, Formosa and Hainan. Very similar ones occur in Indo-China and Siam and eastward to tropical

Australia and New Caledonia and westward into northern India. Over much of the area mentioned the plant may be part of the indigenous flora even though it may appear as a weed tree or, because of reputed medicinal properties of its fruit, be sometimes cultivated. Enough small differences can be detected to suggest that perhaps it may display several minor geographically correlated tendencies possibly worthy of nomenclatorial recognition. At present, however, without field studies any attempt at segregation is premature. Observations in various places must be made as to what proportion of the material passing as *C. dichotoma* is probably indigenous and what proportion may be selected cultivated forms disseminated by man and possibly of foreign origin. Field observations are also needed as to the flowering habits of the plant. In our area they appear to produce exclusively male or exclusively hermaphrodite flowers and never both on the same tree. There is a possibility that trees in some regions may produce only the fertile hermaphrodite flowers and never any of the sterile male. This needs verification, as also the report that the male and hermaphrodite flowers may both be developed in a single mixed inflorescence, or that one or the other may appear abundantly and exclusively on a single tree but at different seasons of the year. Notes on the size, shape, and color of the mature fresh drupes are also needed. Available data on these details are contradictory and confusing.

Until Hutchinson, Kew Bull. 1918: 217–221, f. 1 (1918), published a note on *Cordia Myxa* L., the Asiatic and East Indian plants were commonly identified with that plant of Africa and the Near East. The African *Cordia Myxa*, sens. str., appears to be a recognizable form, but actually it is no more distinct than some other forms in the same circle of relationship. Certainly it is not set off so nicely as Hutchinson's key and discussion would suggest. Its relations are closest with the p'ant of peninsular India described as *C. obliqua* Willd. Since it is reported as always associated with Man it may be only a cultivated race, possibly even of Indian origin. *Cordia Myxa* and also *C. obliqua* and its allies in India differ from the plant here called *C. dichotoma* in their broad rounded thickish non-acuminate leaves, as well as in their coarser flowers and very much larger drupes. Typically their leaves are less than once and a half as long as broad. Frequently they are about as broad as long. The thinner, more elongate, frequently acuminate leaves of *C. dichotoma* are usually once and a half to twice as long as broad. They are never subcordate at the base, as is not infrequently the case with the leaves of *C. Myxa* and relatives. The Indian plants representing phases or close allies of *C. obliqua* are much more diverse than the Asiatic and East Indian plants assigned to *C. dichotoma*. The discussion by Roxburgh, Fl. Indica 2: 330–39 (1824), of *C. latifolia*, *C. Myxa*, and *C. tomentosa* is pertinent here. As economic plants *C. Myxa* and *C. obliqua* and allies seem to be more important than any of the forms of *C. dichotoma*. It is to be expected that some of the Indian p'ants, because of their very large drupes, may have been introduced further east into an area formerly

occupied only by *C. dichotoma*. The plant described as *C. obliqua* in the Flore Générale de l'Indo-Chine 4: 200 (1914) appears to be such.

5. **Cordia cochinchinensis** Gagnep., Not. Syst. 3: 35 (1914) and Fl. Indo-Chine 4: 203, f. 24 (1914) — type from Indo-China.

Small tree or clambering shrub 2–3 m. tall; leaves oblong to elliptic or narrowly ovate to obovate, nearly glabrous, entire, 6–12(–"16") cm. long, 2.5–5(–"9") cm. broad, base acute to rounded, apex acute to short or acuminate, upper surface minutely punctate, petiole 1.5–3 cm. long; inflorescence terminal on short leafy twigs, usually dense and longer than broad, flowers relatively few, crowded on few stout stiff divaricate branches; flowers hermaphrodite (no male flowers seen), calyx deeply cup-shaped, ca. 7 mm. long, with 4–5 irregular triangular lobes, outside glabrous; corolla 14–16 mm. long, glabrous, tube about as long as the corolla-lobes, filaments 3.5–4.5 mm. long, glabrous or with scattered short hairs, anthers 1.5 mm. long; style with basal column 3 mm. long, first branch 1 mm. long, ultimate branches 3.5–5 mm. long, slender; drupe subglobose, usually 1.5 cm. in diameter (becoming 3 cm. long and 2.2 mm. thick, fide Gagnepain), supported by the explanate indurate saucer-shaped calyx 1–1.5 cm. in diameter.

Hainan and Indo-China; reported from Siam.

HAINAN: Yaichow, shrub in thicket near sea, *F. C. How 70895* (A, NY); Naam Shan Leng, erect, 5 m. tall, *S. K. Lau 255* (A); Fung Leng, erect, 2 m. tall, *S. K. Lau 485* (A); Kumyun, scandent, *S. K. Lau 27741* and *27849* (A).

INDO-CHINA: Cambodge, 1929, *Bejeaud 45* (A, NY).

The description given above is based upon the cited specimens. It agrées with the illustration of *C. cochinchinensis* published by the author of the species but differs from the original description in details and especially as to size of mature fruit. Fruiting specimens from Hainan have drupes, perhaps slightly larger but generally similar to those of *C. dichotoma*. The fruit described by Gagnepain is nearly twice as large and hence much resembles the fruit of *C. obliqua*. Some collections from southern Indo-China and Siam have the dense contracted inflorescence of *C. cochinchinensis* but have broad leaves that are suggestive of those of *C. obliqua*. Such plants, associated also with large fruit, leave the species distinguished only by the contracted inflorescence. Pending further study, I have restricted *C. cochinchinensis* to the form found on Hainan.

Excluded or Unplaced Species

Cordia venosa Hemsley, Jour. Linn. Soc. Bot. 26: 143 (1890).

Based upon collections from Ningpo Mts., Chekiang, *Faber 183*. Rehder, Jour. Arnold Arb. 12: 76 (1931), reports that it represents *Clerodendron cyrtophyllum* Turcz., of the Verbenaceae.

Cordia sinensis Lam., Tab. Encyc. 1: 423 (1791); Poir., Encyc. 7: 49 (1806); DC., Prodr. 9: 500 (1845).

Based on material said to have been collected by Sonnerat in China. Leaves oblong, entire, 2–3 inches long and about half an inch broad, with tufts of hairs in the axils of the veins beneath but otherwise glabrous; petiole about an inch long. Not recognized and probably not a member of the Boraginaceae. DeCandolle, Prodr. 9: 500 (1845), suggests that it may be a form of *C. subcordata,* but that is extremely doubtful.

CORDIA SPINESCENS L., Mant. 2: 206 (1771).

Originally stated to be a plant from "India orientali," but actually from tropical America. See Johnston, Jour. Arnold Arb. 30: 103 (1949).

2. COLDENIA L.

Coldenia L., Sp. Pl. 125 (1753) and Gen. Pl. 61 (1754) — type-species, *C. procumbens L.*

Herbaceous or suffruticose plants with slender, forking, usually prostrate or widely spreading stems; leaves small and numerous, subsessile or petiolate; flowers generally extra-axillary, along leafy twigs or at the forks of the branches, sometimes glomerate; corolla mostly small, with cylindric or ampliate tube and spreading lobes, throat naked or sometimes appendaged; style terminal on ovary, short to long, bilobed or biparted, stigmas 2, not conspicuously differentiated from the style-branch; fruit dry, pyramidal or hemispheric or more or less obviously 4-lobed, dividing into usually 4 single-seeded nutlets; nutlets more or less broadly united ventrally or joined to a central prolongation of the receptacle.

The genus consists of *C. procumbens,* the single species of the Old World and the type of the genus, and also twenty species native to arid regions of America. It is a very natural assemblage, is easily circumscribed, and has no close relations. Clearly a member of the Ehretioideae, it differs from all other genera of the subfamily not only in its dry fruit but also in its lowly habitat. One Mexican species forms a dense globose twiggy bush less than a meter tall, but other members of the genus are lowly plants with prostrate or trailing, more or less dorsiventral forking stems, and generally a mat-like habit of growth. All members of the genus have small thickish leaves, and many of them have the veins conspicuously impressed on the upper surface of the leaf. Not only do the *Coldenia* species differ from the other Ehretioids in microphylly, but also in inflorescence. Borne generally away from leaf-axils, their flowers occur between leaves on branchlets or may be crowded into almost bractless glomerules. The open, distinctly forking cymes or the scorpioid clusters developed by other Ehretioids are not produced by *Coldenia.* The organization of the fruit among the species of *Coldenia* is of great interest. Outside the Boraginoideae, that great herbaceous group and certainly the most highly evolved in the family, a fruit in the form of dry nutlets is produced only by *Heliotropium* and *Coldenia.* The range of fruit structure in *Heliotropium* is limited. In the genus *Coldenia,* however, are to be found illustrations of many of the evolutionary stages by which a dry fruit derived from a drupe of the type found in *Ehretia* can divide into nutlets; there is the

first stage, in which the fruit is deeply lobed and the nutlets (the lobes) are joined to one another by portions of their ventral surface; there is the more advanced stage, in which the nutlets are affixed independently by inner angle to a differentiated central axis; and finally there is the stage in which, by the shortening of the central axis, the nutlets shift from lateral to nearly basal in attachment and arise individually from the pyramidal or flattened floral receptacle. Not only in its fruit, but also in its lowly herbaceous or merely suffruticose habit, and even in the development of faucal appendages in the corolla of a few species, the genus shows many approaches to the more highly evolved Boraginoideae. No other genus in the Cordioideae, Heliotropioideae or Ehretioideae shows such close relationship with that subfamily.

Coldenia procumbens L., Sp. Pl. 125 (1753); Clarke, Fl. Brit. India 4: 144 (1883); Gagnep. & Cour., Fl. Indo-Chine 4: 213, f. 25 (1914).

Lobophyllum tetrandrum F. v. M., Hooker's Jour. Bot. & Kew Miscell. 9: 21 (1857) — Australia.

Prostrate annual herb, the stems dorsiventrally compressed, ascendingly branched, 1–5 dm. long, grayish hairy; leaves 5–30 mm. long, 3–15 mm. wide, coarsely crenate-dentate or lobulate, markedly asymmetric, somewhat oblong or obovate, on petioles 0–5 mm. long, upper surface coarsely strigose between the veins, the hairs (frequently with bulbose bases) converging concentrically in the vein-areole or directed towards the apex of the nearest tooth on the leaf-margin, lower surface with spreading hairs, veins impressed on upper leaf-surface and prominent on the lower, simple or weakly branched, terminating at leaf-margin at the base of the acute sinus between the teeth, 4–6 pairs on either side of midrib; flowers minute, subsessile, 4-merous, extra-axillary, borne between leaves or bracts and not subtended or opposed by them; calyx 1.5 mm. long, divided into 4 lanceolate or ovate-lanceolate lobes, persistent, at maturity somewhat accrescent and supporting the fruit; corolla white, glabrous, minute, 1.5–1.8 mm. long, tube 1–1.3 mm. long, cylindric, lobes 0.2–0.4 mm. long, ascending, rounded; filaments 4, attached about the middle of the corolla-tube, included, 0.2–0.4 mm. long, glabrous; anthers broad, 0.1–0.2 mm. long; ovary pyramidal, short-beaked, 0.6 mm. long, sulcate on four sides, glandular villulose; styles borne on beak of ovary, 2, united at base, ca. 0.1 mm. long, terete, stigmatiferous only at apex; fruit 3–4 mm. long, sparingly glandular-hairy, beaked, pyramidal in general form, 4-lobed, first dividing along the very broad dorsiventral commissure into biseminiferous halves, the halves later divided individually along a narrower but more tenacious commissure into single-seeded nutlets; nutlets beaked, frequently somewhat rugose and tuberculate or even bearing subulate processes, the back developing vesicular corky mesocarp and consequently high-convex and rounded, the ventrum sharply angulate, having one large and one small commissural face.

Formosa; Hainan; Indo-China to India and through the East Indies; usually on dessicating land subject to seasonal floodings and accordingly often a weed in dried-out rice paddies.

FORMOSA: Banayotyo, April 15, 1912, *T. Kawakami* (photo, A); Takow, *Henry* (NY).

HAINAN: vicinity of Ka Chik Shan, *S. K. Lau 1701* (G, NY); Chim Fung Ling near Sam Mo Watt Village, *S. K. Lau 3909* (G); Loktung, S. K. Lau *27054* (G); Yaichow, *H. Y. Liang 61918* (G, NY).

INDO-CHINA: Dalat, southern Annam, *R. W. Squires 779* (G, NY); dry rice paddies, Cochinchina, *Thorel 318* (G).

The nutlets of the American species have relatively thin endocarp and no evident development of mesocarp. Their surface is smooth, even polished, or variously papillate. In *C. procumbens,* however, the thicker endocarp is much roughened by strong ridges and protuberances, and the back of the nutlet supports a high rounded mass of vesicular mesocarp. Some of these peculiarities in the nutlet of *C. procumbens* may be associated with the habitat of the plant. The American species are inhabitants of dry sandy or rocky places in arid regions. Such are very different from the periodically inundated places frequented by the Old World species. Under the latter conditions the development of vesicular mesocarp would have a function. By increasing the buoyancy of the nutlet it would serve during periods of flooding as an aid in water dissemination. The unusually thick endocarp might also be useful, since it would provide stout protection for the seed, which must survive not only periods of immersion but also very dry conditions, including baking in the sun.

Coldenia procumbens can develop and flourish on the sunbaked soil of rice paddies subjected to drought, great heat, and intense light. As a remarkable xerophyte it is discussed in a semipopular article by J. Beumée, De Tropische Natur 15: 82–86, f. 1–3 (May 1926). Not only the rigorous conditions which it withstands but also some of its morphologic adaptations are there described.

The veining of the leaves in our species is a morphologic anomaly. The veins, unlike those in other plants with lobed or toothed margins, do not run from the midrib to the tip of a lobe or tooth, but rather to the base of the sinus between the lobes or teeth. DeCandolle, Prodr. 9: 558 (1845), remarks that he knows of such behavior only in *Crataegus oxyacantha* and in the genus *Rhinanthus*. In these, however, only an occasional or secondary vein exhibits this behavior. In our *Coldenia* the primary veins all go to the sinus. Indeed there is no evident veining that reaches the lobe-tips. This behavior is altogether very unorthodox and perhaps unique.

3. ROTULA Loureiro

Rotula Loureiro, Fl. Cochinch. 121 (1790) — type-species, *R. aquatica* Lour.

Rhabdia Martius, Nov. Gen. 2: 136, t. 195 (1827) — type-species, *R. lycioides* Mart.

Zombiana Baillon, Hist. Pl. **9**: 421 (1888) — type-species, *Z. africana* Baill.

Shrub with numerous slender elongate stems; leaves numerous, thickish, not large, petiole short or none; inflorescence a small few-flowered terminal cyme; corolla with 5 spreading rounded lobes and a short tube; stamens exserted; filaments elongate, glabrous; style arising from the apex of the ovary, slender, elongate, terminated by a small somewhat bilobed subpeltate stigma; fruit a drupe, red; endocarp strongly 4-lobed and early breaking up into 4 single-seeded pyrenes.

A genus closely related to *Ehretia* but differing in the simple style and more strongly lobed endocarp, as well as in growth habit and in selection of habitat. It is composed of two very closely related species, *Rotula aquatica,* ranging from India to the Philippines and the East Indies, and **Rotula lycioides** (Mart.) comb. nov. occurring in tropical West Africa and in eastern Brazil. The latter differs from the Asiatic and Malaysian relative in having slightly larger flowers, a usually more ample, minutely glandular inflorescence, and a noticeably reddish tone in its dried foliage. It has synonyms in *Rhabdia lycioides* Mart. (1827), *Rhabdia crebrifolia* Miers (1868), *Zombiana africana* Baill. (1888), and *Rhabdia Pohlii* Kuhlm. (1934). The two species affect the same extreme habitat, both growing in forested tropical regions in rocky or gravelly open places along streams, where they are subjected to protracted periods of inundation during seasons of high water. For a very detailed discussion of the fruiting structure of the genus see Miers, Contr. Bot. **2**: 219–224, t. 84 (1869).

Rotula aquatica Loureiro, Fl. Cochinch. 121 (1790); Bunting, Jour. Bot. **47**: 270 (1909) — type from Indo-China.

Rhabdia aquatica (Lour.) Kuntze, Rev. Gen. **2**: 439 (1891).
Ehretia viminea Wall., Cat. no. 906; DC., Prodr. **9**: 509 (1845); Edgeworth, Jour. Linn. Soc. Bot. **9**: 324 (1867) — type from Burma.
Carmona viminea (Wall.) Don, Gen. Syst. **4**: 391 (1837).
Rhabdia viminea Wall. ex Dalzell, Hook. Icon. **5**: t. 823 (1852).
Ehretia cuneata Wight, Icon. Pl. Ind. Or. **4**: t. 1385 (1848) — type from India.
Rhabdia fluvialis Edgeworth, Jour. As. Soc. Bengal **21**: 175 (1853) — type from India.
Rhabdia sericea Edgeworth, Jour. As. Soc. Bengal **21**: 176 (1853), *nomen.*
Rhabdia lycioides sensu Clarke, Fl. Brit. India **4**: 145 (1883); Duthie, Fl. Upper Gangetic Pl. **2**: 88 (1911); Gagnep & Cour., Fl. Indo-Chine **4**: 214 (1914).

Shrub with many ascending or trailing elongate terete virgate stems, bearing leaves on numerous short annual lateral branchlets 1–10 cm. long; leaves subcoriaceous, thickish, obscurely if at all veined, 0.6–2.5 cm. long, 0.2–0.9 cm. broad, oblanceolate to oblong, usually somewhat strigose or strigose-villose, rarely nearly glabrous, petiole 0.5–3 mm. long; inflorescence a small few-flowered cyme terminating the branchlets; calyx 4–5 mm. long, lobes lance-cuneate, unequal in width, 0.5–1.5 mm. broad; pedicels bracted; corolla pink to purplish, 5–7 mm. long, lobes rounded,

spreading, tube 1–2 mm. long; filaments attached above middle of corolla-tube; style 4–5 mm. long; ovary oblong, about 0.8 mm. long; drupe red, subglobose, 3–4 mm. in diameter.

Southern China, Indo-China, Siam, Burma, India, Ceylon, and Malaya; also in the Philippines, Borneo, and the Celebes.

KWEICHOW: Chengfeng, by stream, *Y. Tsiang 7319* (NY).

INDO-CHINA: vicinity of Hue, Annam, *R. W. Squires 207* (A, NY); 3 km. de Kep, Tonkin, *Petelot 4366* (NY); Luang-prabang, Laos, *Spire 1465* (A); Village de Poun Luong, Muong de Pae Hin Boun, prov. de Cammon, Laos, *Colám, sub Petelot 4322* (NY).

Edgeworth, Jour. Linn. Soc. Bot. 9: 324 (1867), gives some interesting observations concerning the behavior of this plant. "This shrub is very peculiar in its habits, growing upon granitic rocks in the bed of the river often submerged for weeks, its long branches hanging down into the water when the rocks are left exposed. These branches are so flexible and tough that they may be tied into a knot without breaking." Brandis, Indian Trees, pg. xxii (1906), lists the species as one of several Indian plants especially characteristic of such unusual habitats. It is surprising that no detailed study of their habits and life history has yet been published.

4. CARMONA Cav.

Carmona Cav., Icones 5: 22, t. 438 (1799) — type-species, *C. heterophylla* Cav.

Shrubs or trees; leaves small, short-petiolate, usually coarsely toothed, mostly fasciculate; corolla white, with short tube and broad spreading lobes; filaments slender, elongate, anthers exserted; style terminal on ovary, branched near the base, the two arms slender and elongate; stigmas 2, minute, subcapitate; drupe red; endocarp bony, subglobose, short-rostrate at apex, 4-seeded, remaining entire, not breaking up into pyrenes.

A monotypic genus obviously related to *Ehretia* but differing markedly in the organization of the endocarp and in its very deeply cleft or almost divided style, as well as in the distinctive growth-habit and general appearance of the plant. It is surprising that it has so long gone without general recognition.

Unlike that in *Ehretia*, the mature endocarp in *Carmona* does not divide in half along the dorso-ventral axis. It remains a unit, a subglobular body, short-beaked at the summit and more or less rugose externally. At various levels from the base upwards cross-sections show changing arrangement of internal cavities. The four large seminiferous cavities are in pairs on either side of the dorso-ventral line and extend for nearly the length of the endocarp. In cross-sections near the base of the endocarp they are accompanied by five sterile cavities, two large lateral ones on the dorso-ventral line, a small central one, and a small lateral one to the left and right of both pairs of fertile cavities. At a higher level a section shows a set of three tiny cavities along both the left and the right side of the endocarp. The tiny central cavity is here replaced by two tiny sterile cavities, one interposed between the members of each pair of fertile cavities.

Accordingly there are eight sterile cavities at a level just below the middle of the fruit. In the upper half of the endocarp, first two and later three large sterile cavities appear along the dorso-ventral line. There are no tiny sterile cavities interposed in the pairs of fertile cavities, while the sets of tiny cavities to the left and right of the fertile cavities may be present, only to disappear at slightly higher levels. The number of sterile cavities within the endocarp of *Carmona* that are visible in any transverse section, accordingly, may vary from eight to three. Four seeds are commonly matured in each endocarp.

In *Ehretia* the sterile cavities present along the dorso-ventral axis of the endocarp are broad and well developed. They destroy the solidity of the endocarp. Indeed they are instrumental in forming the primary commissure along which it divides in half at maturity. Also unlike that of *Carmona* the endocarp of *Ehretia* regularly has a well-developed sterile cavity interposed between the members of each pair of seed-bearing cavities. This sterile cavity is commonly about as large as the fertile one on either side of it. It may have four stout bony walls or the wall next to the exterior of the endocarp may be very weak or partially absent. When the latter condition exists the endocarp is further weakened structurally and after dividing in half always divides again to form four single-seeded pyrenes. The second division of the endocarp is effected by breakage of the walls of the sterile cavity mentioned. The endocarp of *Ehretia* in its internal structure and function is accordingly very different from that of *Carmona*.

Carmona microphylla (Lam.) Don, Gen. Syst. **4:** 391 (1837).

Ehretia microphylla Lam., Tab. Encyc. **1:** 425 (1791?); Poir., Encyc. Suppl. **2:** 1 (1811); Kanehira, Formosan Trees 637, f. 594 (1936); W. H. Brown, Useful Pl. Philippines **3:** 270, f. 104 (1946) — type from East Indies, *Sonnerat.*

Ehretia buxifolia var. *microphylla* (Lam.) DC., Prodr. **9:** 509 (1845).

Cordia retusa Vahl, Symb. **2:** 42 (1791) — type from East Indies.

Carmona retusa (Vahl) Masamune, Trans. Nat. Hist. Soc. Formosa **30:** 61 (1940).

Ehretia buxifolia Roxb., Pl. Coromandel. **1:** 42, t. 57 (1795) and Fl. Indica, ed. Car. & Wall. **2:** 343 (1824); Clarke, Fl. Brit. India **4:** 144 (1883) — India.

Carmona heterophylla Cav., Icones **5:** 23, t. 238 (1799). — "Habitat prope Manbulac in insulae Luzon, et in Huamantae altera ex Marianis. *Nees.*"

Ehretia heterophylla (Cav.) Spreng., Syst. **1:** 848 (1825).

Ehretia buxifolia var. *heterophylla* (Spreng.) Gagnep. & Cour., Fl. Indo-Chine **4:** 207 (1914).

Ehretia dentata Courchet, Not. Syst. **3:** 35 (1914) and Fl. Indo-Chine **4:** 206, f. 24 (1914) — Indo-China.

Ehretia buxifolia var. *latisepala* Gagnep., Fl. Indo-Chine **4:** 207 (1914) — type from Cochinchina, *Thorel.*

Shrub, much branched, 1–4 m. tall, or rarely a tree to 10 m. tall; branches slender, 1–3 mm. thick, with internodes usually 1–2 cm. long, when young usually minutely hispid and frequently also puberulent; leaf-

axils at first with small brownish tomentose buds, later with pulvinate brownish tomentose short-shoots which may continue to produce inflorescences and leaf clusters for several years; leaves variable in size, form, and dentation, very numerous, borne singly along vigorous new shoots or clustered on the short-shoots along older branches, usually broadest well above the middle and commonly somewhat toothed or crenate towards the apex, 0.8–6(–10) cm. long, 0.5–2.5(–4) cm. broad, from above the middle gradually contracted downwards into a petiole 1–5(–10) mm. long, apex rounded to obtuse or rarely acute, margin usually somewhat recurved, upper surface lustrous, with impressed veins and costa, usually bearing short rigid somewhat appressed hairs arising from dot-like clusters of pallid mineralized epidermal cells, usually scabrous, lower surface dull, paler, commonly hispidulous; inflorescence completely bractless, peduncle very slender, 0.2–2.5 (–4) cm. long, arising from the leaf-axils or from the pulvinate short-shoots; flowers usually 2–6 in a loose glomerule 5–12 mm. in diameter or occasionally in a scantily branched open cyme 2–5 cm. broad; calyx 3–6 mm. long, borne on pedicels 0–7 mm. long, lobes linear or linear-spathulate, usually narrowed below the middle, 0.4–0.8 mm. broad, sparsely hispidulous, tube 0.3–1 mm. long, usually densely hairy on the inner surface; corolla white, 4.5–6.5 mm. long, limb 6–9 mm. in diameter, lobes spreading broad 2.5–4.5 mm. long, tube 1.7–2 mm. long, base 1.5 mm. broad, 2.5–4 mm. broad at summit; filaments 2.5–3.5 mm. long, attached 0.3–0.5 mm. above base of corolla-tube; anthers oblong, 1.8–2 mm. long; ovary glabrous; style 4.5–6.5 mm. long, deeply lobed or nearly divided, lobes 3–5 mm. long; drupe 5–6 mm. in diameter, red or yellow; endocarp 3–4 mm. in diameter, globular, short-rostrate, rugose, remaining entire, not breaking up into pyrenes, containing 4 seeds, and at various levels between base and summit with 3–8 sterile cavities.

Kwangtung, Ryukyu to Hainan, southern Asia, and eastward to New Guinea and the Solomon Islands.

KWANGTUNG: Pak-sha, Luichow Peninsula, *Hance 9368* (A).

RYUKYU ISLANDS: without locality, *Wright 206* (G), *S. Sakaguchi 3017* (A); Miyako-zima, *Kanehira 3208* (NY); Naha, Okinawa, *without collector 142* (NY).

FORMOSA: Taihoku, cultivated, *U. Moro* (A); Tekow, *Henry* (A, NY).

HAINAN: Hoihow, *McClure 7575* (A); Liamui (Leng Mun), *Gressitt 1184* (A); Ta Hau, *Gressitt 958* (A); Ta Hian, *Gressitt 738* (A); Chim Fung Ling, *S. K. Lau 3382* (A); Ue Lung Shan, *S. K. Lau 3200* (A); Ka Chik Shan, *S. K. Lau 1578* (A, NY); I Kap Shan, *S. K. Lau 1145* (A, NY); Yeung Ling Shan, *S. K. Lau 137* (A); near Po-ting, Lingshin, *H. Y. Liang 61584* (A); Lam Ko District, *C. I. Lei 1306* (A); Manning, *F. C. How 71472* (A); west side of Po-ting, Lingshin, *P. S. Lo 62409* (A); Po T'eng Shi (BoDeng), *H. Fung 20027* (A); Hung Mo Shan, *Tsang, Tang & Fung 77* (A); Nodoa, *Wai-Tak Tsang 15513* (A, NY); Ngau Ma Woh, *Wai-Tak Tsang 415* (A); without locality, *Henry 7952* (A), *Native Collector, Hongkong Herb. 1994* and *2184* (A).

INDO-CHINA: Tourane, *Clemens 3212* (A); Phuoc-than, *Thorel 1191* (A).

The species varies greatly in leaf-size and in the nature of the leaf-margin, but much of this variation is no doubt ecological in origin. It is usually a shrub 1–3 m. tall. However, some otherwise indistinguishable plants from New Guinea are described by their collectors as forming trees as much as 10 m. tall. As a cultivated plant I have seen collections of the species from Florida, Cuba, and Honduras.

5. EHRETIA L.

Ehretia L., Syst. ed. 10, 936 (1759) — type-species, *E. tinifolia* L.

Traxilum Raf., Sylva Tellur. 42 (1838) — type-species, *E. aspera* Roxb.

Trees and shrubs; leaves small to large, usually distinctly petiolate, margins entire or serrate; corolla white or yellowish, tube campanulate or elongate, lobes spreading or recurved; filaments elongate, the anthers usually exserted; style terminal on ovary, cleft above the middle; stigmas 2, small, capitate or elongate; drupe subglobose, mostly yellow, orange, or reddish, glabrous; endocarp at maturity breaking apart into either 2-seeded or single-seeded pyrenes.

The genus *Ehretia* has numerous species in Africa, in southern Asia, and in the East Indies. Only three species are known from America, but one of them, *E. tinifolia* L., is the type of the genus. The genus is well marked and homogeneous and has its closest relations in *Rotula* and *Carmona*. Its species can be grouped into two sections according to the nature of their endocarp. In the section *Euehretia* the endocarp promptly, or in some species only tardily, breaks in half to form two-seeded pyrenes. The section *Bourrerioides* contains species having endocarps that eventually divide into four single-seeded pyrenes. Most members of *Ehretia* have entire leaves, the chief exception being a group of species ranging in Asia, Malaysia, and America. These latter have regularly and sharply serrate leaf-margins, belong to *Euehretia,* and appear to be a natural assemblage.

Key to the Species

Leaves serrate; endocarp dividing into 2-seeded plano-convex halves.
- Corolla-lobes longer than the tube; fruit small; toothing on leaf-margin antrorse, with thickened, strict or incurved tips.....1. *E. acuminata.*
- Corolla-lobes shorter than the tube; fruit larger; toothing on leaf-margin spreading, not thickened at tip.
  - Fruit moderate, endocarp 6–8 mm. in diameter; leaves usually somewhat cordate at base.....2. *E. corylifolia.*
  - Fruit large, endocarp 9–12 mm. in diameter; leaves usually acute to somewhat rounded at base.....3. *E. Dicksoni.*

Leaves entire (or rarely coarsely toothed in no. 10); endocarp breaking up into single-seeded quarter-sections.
- Corolla-lobes shorter than the tube or at most equalling it.
  - Tube of corolla cylindric; calyx-lobes linear, 4–6 mm. long; Formosa.....4. *E. resinosa.*

Tube of corolla evidently expanding from the base upwards, very much broader at top than at bottom; calyx-lobes 0.5–2 mm. long.
Corolla-tube short and wide, very broadly expanding, funnelform, 2.5–3.5 mm. long, 1.5 mm. wide at base, 5–6 mm. wide at top, bearing filaments 1.5 mm. above its base; inflorescence terminal on new leafy twigs; Yunnan.....5. *E. confinis.*
Corolla-tube elongate, narrowly expanding, 4–10 mm. long, 1.5–2 mm. broad at base, 3–5 mm. broad at summit, bearing filaments 3–6 mm. above the base; inflorescence borne terminal or axillary on old shoots just previous to or during the time of leaf renewal.
Lobes of corolla equalling or only slightly shorter than the tube; leaves with evident secondary and tertiary veining; inflorescence very scantily glandular; Kwangsi and Yunnan.....6. *E. Tsangii.*
Lobes of the corolla evidently much shorter than the tube.
Leaves with evident secondary and tertiary veins; young twigs, inflorescences and calyx densely and minutely glandular; corolla less than 10 mm. long; Kweichow and Yunnan.....7. *E. Dunniana.*
Leaves with only primary veins evident, the secondary very obscure if at all discernible; plant not glandular; corolla 10–13 mm. long.....8. *E. longiflora.*

Corolla-lobes longer than the tube.
Inflorescence terminating leafy twigs, bearing small persistent linear bracts scattered on its branches; flowers mostly with slender very evident pedicels; leaves entire or with very coarse irregular teeth.....9. *E. asperula.*

Inflorescences not only terminal but also springing directly from leaf-axils, bractless or bracteate only on the primary axis; leaves always entire.
Calyx and inflorescence abundantly tawny-tomentulose; leaves broad, usually 1½–2 times longer than wide, apex obtuse or rounded; flowers sessile, at or before anthesis borne crowded in two evident ranks unilaterally along the ultimate branches of the inflorescence and hence somewhat scorpioid in arrangement; Hainan.....10. *E. laevis.*
Calyx and inflorescence glabrous or minutely and inconspicuously pubescent; leaves elongate, 2–4 times longer than wide, with an acuminate apex.
Petioles 1.5–3 cm. long; plant not darkening in drying; inflorescence sparingly branched, the branches becoming elongate, bearing the flowers unilaterally in two loose ranks, moderately scorpioid; Hainan.....11. *E. hainanensis.*
Petioles 0.7–1 cm. long; plant darkening in drying; inflorescence with very slender axis and branches, a repeatedly forking cyme, occasionally contracted but usually loose, its flowers not at all scorpioid in arrangement; Indo-China.....12. *E. dichotoma.*

1. **Ehretia acuminata** R. Br. var. **obovata** (Lindl.), comb. nov.

Ehretia serrata var. *obovata* Lindl., Bot. Reg. **13:** sub t. 1097 (1827) — type from China.

Ehretia ovalifolia Hasskarl, Cat. Hort. Bogor. 137 (1844) — a Japanese plant cultivated at Buitenzorg, Java.

Cordia thyrsiflora Sieb. & Zucc., Abh. Akad. Muench. **4³:** 150 (1846) — type from Japan.

Ehretia thyrsiflora (S. & Z.) Nakai, Trees and Shrubs Japan **1:** 327, f. 179 (1922); Nakai, Fl. Sylv. Korea **14:** 20, t. 4 (1923); Nakai, Jour. Arnold Arb. **5:** 38 (1924); Hu & Chun, Ic. Pl. Sinicarum t. 99 (1929).

Ehretia acuminata var. *grandifolia* Pampanini, Nouv. Giorn. Bot. Ital. ser. 2, **17:** 699 (1929) — based on material from northwestern Hupeh, China, *Silvestri 1920, 1921,* and *1922.*

Ehretia thyrsiflora var. *latifolia* Nakai, Trees and Shrubs Japan **1:** 329 (1922) and Jour. Arnold Arb. **5:** 38 (1924) — type from Japan.

Ehretia taiwaniana Nakai, Jour. Arnold Arb. **5:** 38 (1924); Kanehira, Formosan Trees 639, f. 596 (1936) — type from Formosa.

Ehretia Argyi Lévl., Fedde Repert. **11:** 67 (1912); Rehder, Jour. Arnold Arb. **18:** 243 (1937) — type from Kiangsi, *d'Argy.*

Ehretia kantonensis Masamune, Trans. Nat. Hist. Soc. Formosa **30:** 60 (1940) — type from Tungshan, Kwangtung, *Tsing Ying 1787.*

Ehretia serrata sensu Shirasawa, Ic. Essent. Forest Trees Japan **2:** 69 (1908).

Ehretia acuminata sensu auct. pl.; Wilson, Pl. Wilson. **3:** 362 (1916); Gagnep. & Cour., Fl. Indo-Chine **4:** 209 (1914).

Tree 3–15 m. tall, glabrous or inconspicuously short-strigose especially on the inflorescence and upper surface of young leaves; twigs usually brownish; axillary buds on leafy shoots usually elliptic, very depressed, elongate and usually low-convex, generally single; leaves elliptic to obovate or narrowly obovate, broadest at or above the middle, 15–20 cm. long, 4–10 cm. broad (most commonly 8–15 cm. × 4–6 cm.), apex rounded or angled and frequently somewhat acuminate, base acute to rounded, margin finely and regularly serrate, the teeth ascending, usually with slender prolonged thickened strict or incurved tips, upper leaf-surface usually with scattered appressed inconspicuous hairs, lower surface glabrous or nearly so; inflorescence paniculate, 10–20 cm. long, 5–13 cm. broad, terminal on a leafy shoot, its lower branches usually subtended by well-developed leaves and either truly axillary or springing from the uppermost of two potential axillary buds and accordingly arising 1–3 mm. above the leaf attachment; flowers small, very numerous, fragrant; calyx sessile, 1.5–2 mm. long, lobes 0.8 mm. long, rounded and with ciliolate somewhat scarious margins; corolla white, 3–4 mm. long, lobes 2–3 mm. long, about 1.5 mm. wide, spreading, tube about 1 mm. long; filaments 2–3 mm. long, attached about 0.5 mm. above base of tube; anthers 1 mm. long; style 1.5–2 mm. long, its lobes 0.2–0.8 mm. long; fruit more or less orange or yellow (or rarely even red), 3–4 mm. in diameter; endocarp with outer surface rugose or scrobiculate, at maturity dividing into biseminiferous halves.

Ranging from Hupeh, Kiangsu, and Shantung, and from southern Japan south to northern Indo-China and Hainan.

SHANTUNG: Yen Miao, *J. Hers 1924* (A).

HONAN: Yü Tai Shan, Teng Feng Hsien, *J. Hers 282* (A).

KIANGSU: Kiangyin, *Allison 186* (G); Huang Tsang Yü, Siao Hsien, *J. Hers 1001* (A); Spirit Valley, Nanking, *A. N. Steward 2159* (A); Nanking, *K. Ling 7936* (A); Ih-shing, *R. C. Ching 4881* (A); I-shing, *Ching & Tco 711* (A); without locality, *d'Argy* (photo of type of *E. Argyi*, A).

ANHWEI: Wu Yuen, *K. Sing 7873* (A); without locality, *R. C. Ching 3099* (A).

HUPEH: Ma-pan-scian, *Silvestri 1919* (A); Nan-to, *Henry 1941* (G); Changyang, *Wilson 818* and *1103* (A); Ichang, *Wilson 74* (A); Siao-Ya-Tsze, *W. Y. Chun 3633* (A); Hsing-shan Hsien, *Wilson 74A* (A); without locality, *Henry 4556* (G) and *6358* (A).

CHEKIANG: Tien-moo-shan, *R. C. Ching 5089* (A), *5135* (A), and *5101* (A); without locality, *R. C. Ching 1804* (A) and *1758* (A).

HUNAN: betw. Tsing Chow and Wukang, *Handel-Mazzetti 340* (A).

KIANGSI: Ta Yu Hsien, *H. H. Hu 964* (A); Hwang Yen Sze, Lu Shan, *Steward & Cheo 286* (A); Lam Uk Village, Lunguan district, *S. K. Lau 4650* (A).

FUKIEN: Kuliang, *H. H. Chung 6635* (A); without locality, *R. C. Ching 2516* (A).

KWANGTUNG: Canton, *C. O. Levine 446* (A); Pak-wan Cheung, Wai-yeung District, *T. M. Tsui 173* (A); Wan Tong Shan, Ying Tak District, *T. M. Tsui 410* (A); Kochow District, Paiyunshan, *Tsiang Ying 2191* (A); Ying-tak District, *Y. K. Wang 2833* (A); Hong Kong, *Wright 415* (G).

KWANGSI: Ling Yün Hsien, Na Hung, *Steward & Cheo 355* (A); Lung-mu-an, Kwei-lin District, *W. T. Tsang 27779* (A); Hang-On-Yuen, *Z. S. Chung 81798* (A); Hang-an, *McClure 20558* (A); north of Luchen, *R. C. Ching 5603* (NY).

YUNNAN: Shweli-Salween divide, lat. 25°45′, *Forrest 24303* (G); Shweli-Salween divide, lat. 25°30′, *Forrest 15821* (A) and *24276* (G); Mingkwang Valley, lat. 25°15′, *Forrest 7733* (G); near Pe-Yen Tsin, *Ten 310* (A); Szemao, *Henry 10454* (A); Fo-Hai, *C. W. Wang 73630, 73726, 73857, 74379, 74434,* and *76110* (A); Nan-Chiao, *C. W. Wang 75106* (A); Che-li Hsien, *C. W. Wang 75477* (A); Keng-Ma, *C. W. Wang 72826* (A); Dah-meng-lung, Che-li Hsien, *C. W. Wang 77927* (A).

JAPAN: KYUSHU: Hokozaki, Fukuoka, *K. Ichekawa 43* (A); Mt. Sobo, Bungo, *K. Sakurai* (A); Kirishima, *R. Yatabe* (A); Nagasaki, *Oldham 581* (G); Nagasaki, 1863, *Maximowicz* (G).

RYUKYU ISLANDS: Okinawa, Naja, *Wilson 8018* (A); without locality, *Wright 205* (G).

FORMOSA: South Cape, *Henry 922* and *952* (A); Bankinsing, *Henry 433* (A) and *506* (A); Takow, *Henry 1778* (A), *1778A* (A), *1874* (A), and *1135* (A); Korisho, *Faurie 392* (A); Taihoku, *Faurie 1852* (A); Maruyama, *Faurie 303* (A); Paehiran, *Faurie 302* (A); Sinpo, Sintiku-syn, *K. Odashima 17853* (A); Kuraru, *Gressitt 42* (A); Pinan, *Wilson 11133* (A); Tamsuy, *Oldham 348* (G); without locality, *Faurie 8270* (A) and *8271* (A), *Oldham 349* (G).

HAINAN: Bak Sa, *S. K. Lau 26174* (A); To-ting, *F. C. How 71648* (A); Lokwui, *F. C. How 72294* (A); Base of Dom, *W. Y. Chun 6493* (A); Manyun, *S. P. Ko 52133* (A); Sin Woh, *W. T. Tsang 17105* (A, NY); Tai Wong Ling, *C. I. Lei 492* (A); Pak Shik Ling, *C. I. Lei 698* (A); without locality, *Henry 8274* (G).

INDO-CHINA: Tonkin: Muong Thon, road from Hanoi to Hoa Binh, *Petelot 4829* (A); betw. Dong Mo and Van Linh, *Petelot 6382.*

This tree of China, Japan, Formosa and Hainan is most closely related to the tropical form of the species, **E. acuminata** var. **pyrifolia** (Don), comb. nov. This latter, based on *E. pyrifolia* D. Don, Prodr. Fl. Nepal. 102 (1825), ranges from eastern India and southern Indo-China to Java and eastward to New Guinea and the Cape York Peninsula of extreme northeastern Australia, and differs from our plant in having thinner, usually smaller leaves, broadest at or below the middle, and commonly much darkened in drying. Some of these differences are to be expected between plants inhabiting tropical as opposed to subtropical and temperate regions. However, our plants show morphologic tendencies never developed by the more southern tropical form. The result is differences in aspect when a series of specimens from the two areas are compared. It accordingly seems useful to separate the plants as weak geographical varieties.

Plants of the Chinese mainland commonly have large abundantly flowered inflorescences and leaves obovate-oblong in outline and hence noticeably broadest above the middle. Those from Japan usually have a much more slender, sparsely-flowered inflorescence and elliptic leaves broadest near the middle. The differences, apparent when many specimens are compared, are, however, simply very strong tendencies. In Formosa and Hainan trees with dense or sparse flower-clusters and either elliptic or obovate leaves are about equally common. Some Chinese specimens are indistinguishable from the most distinctive forms of Japan, and *vice versa.*

Our plant in southwestern China approaches the range of the Himalayan **E. acuminata** var. **serrata** (Roxb.), comb. nov. This was originally published as *E. serrata* Roxb. Hort. Bengal 17 (1814), *nomen,* and Fl. Ind., ed. Carey and Wall. 2: 340 (1824). Illustrations of it are given by Lindley, Bot. Reg. 13: t. 1097 (1827) and by Wight, Ill. Ind. Bot. 2: t. 170 (1850). It grows across northern India from Assam to Kashmir and is characterized by its sharply serrate, usually slenderly acuminate, lanceolate leaves. Its drupes are reported to be red rather than orange, as is generally the case in the var. *obovata* of China. Plants of Yunnan, all of which I consider referable to the var. *obovata,* may have somewhat lanceolate leaves and be more sharply serrate than is usual among Chinese plants. This may be evidence of intergradation between the Chinese and Indian varieties, which certainly can be expected in this transitional area.

Typical *E. acuminata* R. Br., with which our plant has been identified in the past, is separable from it, at least varietally. Typical *E. acuminata* is confined to the middle section of coastal eastern Australia; the type came from the vicinity of present-day Sydney. It has elongate leaves

which, like those of var. *obovata* but unlike those of its other varieties, are usually broadest above their middle. Its inflorescence is distinctive. The branches of the flower-cluster are elongate, scantily branched, and sufficiently slender to be commonly somewhat disarranged in the preparation of specimens. The flowers they bear are in globose glomerules. In other than the typical variety of *E. acuminata,* the flowers on the stiffer divaricately branched inflorescence are borne in much looser, usually subracemose glomerules. The var. *typica* is the most distinct of the geographical varieties within the widely dispersed *E. acuminata* sensu lat. It is confined to middle eastern Australia. The var. *pyrifolia* ranging through the East Indian Islands reaches northeastern Australia but is separated from the var. *typica* by a geographic hiatus, and furthermore, because of habit difference, can be distinguished from the latter at a glance. This is also true of **E. acuminata** var. **pilosula** (F. v. M.), comb. nov., based on *E. pilosula* F. v. M. (1865), which is known only from localities at the base of the Cape York Peninsula, just south of those from which the var. *pyrifolia* is known in Australia. The var. *pyrifolia,* indeed, is very close to the var. *pilosula,* differing from the latter only in having the lower leaf-surfaces glabrous or nearly so, rather than abundantly short-hairy. Another very close relative of the var. *pyrifolia* is the endemic Philippine **E. acuminata** var. **polyantha** (DC), comb. nov. — *E. polyantha* DC. (1845). It represents a geographic race tending to have a much larger pubescent inflorescence and smaller flowers.

Characteristic var. *obovata* is cultivated in the Arnold Arboretum. I have also seen specimens from trees grown at Atlanta, Georgia, at Gotha, Florida, and at Paris, France. The Himalayan var. *serrata* is represented by specimens cultivated in Australia (Brisbane Bot. Garden, *White 2368;* Palace Grounds, Sydney, *Camfield*), Egypt (Cairo, *Bornmüller 10665*), Florida (Gotha, 1920, *Rehder*) and Brazil (Sao Paulo, *Hoehne 30662*). Typical Australian *E. acuminata* I know in cultivation only from California (Santa Barbara, Franceschi Park, 1947, *Reed Moran 2328*).

2. **Ehretia corylifolia** C. H. Wright, Kew Bull. 1896: 25 (1896) — type from Mengtse, Yunnan, *Hancock 153.*

Shrub or tree, 2–15 m. tall; leaves ovate to elliptic, 9–15(–18) cm. long, 4–8(–11) cm. broad, margin usually evidently serrate, apex acute, base usually somewhat cordate or rounded, rarely obtuse; upper leaf-face green, usually strigose and somewhat scabrous; lower leaf-face paler, the indument of softer, usually curved hairs, commonly thinly tomentose or somewhat velvety, though at times sparse or nearly absent; inflorescence terminal, paniculate, 4–15 cm. broad, borne on a peduncle 2–5 cm. long, the major branches commonly subtended by linear deciduous bracts about 5 mm. long; flowers white or yellowish, fragrant; calyx 3–3.5 mm. long, lobes slender, 2–3 mm. long, linear or cuneate; corolla 10–12 mm. long, lobes to 3 mm. long, somewhat recurved outer face minutely strigulose, corolla-tube 7 mm. long, gradually expanding, 2 mm. thick at the base, 3–5 mm. thick at the summit; filaments 3.5–5 mm. long, attached

5 mm. above base of tube; anthers 2 mm. long, oblong; style 7–8 mm. long, usually with some appressed hairs, lobes about 1 mm. long; drupe yellow, reddish yellow or orange, endocarp 6–8 mm. long, ellipsoidal to subglobose, 5.5–6 mm. thick, its surface rather smooth, dividing into 2-seeded halves at maturity.

Known from Yunnan, southwestern Szechuan and southern Sikang.

YUNNAN: Salwin Valley northwest of Champutong, *T. T. Yü 19159* (A); Meng-hua, Paitupo, *T. T. Yü 15824* (A); Chenkang, Snow Range, Sangeorshan, *T. T. Yü 17109* (A); Shunning, Wenkuankuai, *T. T. Yü 16276* (A); Heluntan near Likiang, *R. C. Ching 20753* (A); Ngerya, border of Chungtien, *K. M. Feng 2775* (A); Hokin, near Sung-kwei, *K. M. Feng 783* (A); Wei-si Hsien, Yeh-Chili, *C. W. Wang 67898* (A); Lan-tsang Hsien, *C. W. Wang 73374* (A); Der-la, Cham-pu-tung, *C. W. Wang 66824* (A); Kun-Ming, *C. W. Wang 62831* (A); Lan Ping Hsien, *H. T. Tsai 56006* (A); Lu-feng Hsien, *H. T. Tsai 53644* (A); Chin-lien-hsiang, Cheng-kiang, *H. Wang 41409* (G); near Feng-tai-szu, Cheng-kiang, *Y. Tsiang & H. Wang 16350* (G); without data, *H. T. Tsai 57071, 57091,* and *57244* (A); without data, *T. T. Yü 7658, 8396, 10334,* and *13510* (A); descent to Yangtze from eastern boundary of Likiang Valley, *Forrest 10748* (G); Shweli-Salwin divide, lat. 25°45′, *Forrest 24326* (A); east flank of Tali Range, *Forrest 4769* (A); without locality, *Forrest 9876* and *9981* (A); Mt. Lauchunshan, southwest of Yangtze bend at Shiku, *Rock 8409* (A); mountains south of Likiang, near Hochin and Chiuho, *Rock 4044* (A); western slopes of Likiang Snow Range, *Rock 4245* (A); watershed of Black River, between Mohei and Maokai, *Rock 2950* (A) and *3064* (A); between Likiang and Taku, *Schneider 3197* (A); near Yangtze between Likiang and Chungtien, *Schneider 2168* (A); near Yungpeh, *Schneider 1698* (A); Yunnan-fu, *Schoch 73* (A); northwestern Yunnan, *Mombeig 195* (A); Pe Yen Tsin, northwestern Yunnan, *Ten 62* (A); Mengtse, *Henry 10548* (A, NY), *10548A* (A) and *10548B* (A, NY); Tohe-hay, *Maire 372* (A); Che-kia-po, *Maire 106* (A); Tong-tchouan, *Maire 483* (A) and *4012* (NY); Ge-choui-tang, *Maire 171* (A) and *426* (A); Suen-oui, *Maire 454* (A).

SZECHUAN: Opien Hsien, *T. T. Yü 890* (A); He-chang Hsien, *T. T. Yü 1134* (A).

SIKANG: Ningyüanfu, *Schneider 842* (A); Te chang, *Schneider 723* (A); between Muli and Kulu, *Rock 24132* (A, NY); Muli Gomba, Muli Litang River valley, *Rock 16123* (A); Mt. Mitzuga, Muli Kingdom, *Rock 18263* (A, NY); Muli Kingdom, *Rock 6478* (A).

As far as can be determined from the literature, *E. corylifolia* is most closely related to *E. macrophylla* Wall. of the eastern Himalayas. It differs from the latter only in its smaller leaves commonly cordate at the base. Wallich's original description, Fl. Ind. ed. Carey & Wall. 2: 343 (1824), and comments by Clarke, Fl. Brit. Ind. 4: 141 (1883), give many details regarding *E. macrophylla*. It was collected near Chundaghiri, Nepal. Its leaves, described by Wallich as ovate, 13–26 cm. long, acute at both ends or sometimes rounded at the base, are described by Clarke as 19 cm. long, 10 cm. broad, broadly elliptic, and rhomboid or rounded at the base. The fruit is said to be 6 mm. long and hence very

similar to that of *E. corylifolia*. The nature and distribution of indument over the plant is also similar.

Our plant appears to be a common and widely distributed tree in Yunnan and to have its northern limit in southern Sikang. Handel-Mazzetti, Symb. Sin. 3: 815 (1936), questionably reports the species from western Kweichow. It can be expected also in the portions of Burma and Indo-China adjacent to southern Yunnan.

(*To be concluded*)

STUDIES OF PACIFIC ISLAND PLANTS, VIII
THE FIJIAN SPECIES OF LAURACEAE

A. C. Smith

In attempting to identify a series of Lauraceae collected by me in Fiji in 1947,[1] I soon became aware that several novelties were represented. It proved difficult to ally these properly without reviewing all the species known from Fiji and considering those from the adjacent archipelagos. The present treatment offers keys to the genera and species of the family now known to occur in Fiji, with citations of literature and available herbarium specimens. For the purposes of this study all the Fijian Lauraceae of the following herbaria were assembled: Arnold Arboretum (A); Bernice P. Bishop Museum (Bish); Gray Herbarium (GH); New York Botanical Garden (NY); and U. S. National Herbarium (US). A few critical types and isotypes were kindly loaned by the authorities of the Royal Botanic Gardens, Kew (K). I am greatly indebted to the curators and directors of the named institutions for their coöperation.

Species of Lauraceae occur with some frequency in the Fijian rain-forests; usually they are small or medium-sized trees, but a few species are among the larger forest trees. Their use as a source of timber is probably fairly limited, but certain species have fragrant bark which is used by the Fijians to perfume coconut and other oils. Thirty-six species of Fijian Lauraceae are here recognized, of which I describe 14 as new; in addition three new combinations are proposed (two of them for Samoan plants). All the Fijian species appear to be endemic with the exception of the widespread parasite, *Cassytha filiformis*, and *Endiandra elaeocarpa*, which is also noted from Samoa. As has been observed in other families of predominantly rain-forest trees in Fiji, specific endemism approaches 100 per cent, the relationships of species being either local or with plants from the New Hebrides or Samoa.

KEY TO THE GENERA OCCURRING IN FIJI

Foliose trees or shrubs, not parasitic.

Inflorescence paniculate, the flower-clusters not enclosed by an involucre of imbricate bracts; flowers hermaphrodite (in our species).

Anthers 4-celled; stamens 9 in our species, the 6 outer ones with introrse anthers and eglandular filaments, the 3 inner ones with extrorse anthers and filaments biglandular near middle; staminodes 3, stipitate; fruit a berry borne on a small cupule. . . . . 1. *Cinnamomum*.

[1] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

Anthers 2-celled.
Fertile stamens 9, the 6 outer ones with introrse anthers and eglandular filaments, the 3 inner ones with extrorse anthers and filaments with basal short-stalked glands; staminodes 3, subsessile; fruit subglobose or ellipsoid, completely surrounded by the perianth-tube.....2. *Cryptocarya.*
Fertile stamens 3, with extrorse or rarely lateral anthers, the filaments biglandular toward base with sessile glands; staminodes 3, sessile, subglobose, minute; fruit free, elongate and subcylindric in our species.....3. *Endiandra.*
Inflorescence umbellate-racemose, the umbels (sometimes solitary in leaf-axils) enclosed by an involucre of imbricate bracts; flowers unisexual; anthers 4-celled; fruit a berry borne on a small cupule.....
.....4. *Litsea.*
Parasitic herbs, the leaves reduced to scales.....5. *Cassytha.*

1. CINNAMOMUM Burm.

Although it is obvious that several species of *Cinnamomum* are present in Fiji, it is difficult to differentiate them, primarily because fertile material seems to be particularly scarce in this genus. Two of the entities here discussed, *C. pedatinervium* and *C. camphoratum* var. *"fitiana,"* were described by Meissner on the basis of sterile material. Curiously, neither of these has since been collected in flowering or fruiting condition, although flowers are known for the other species here recognized. My key is based largely on leaf-characters such as shape, size, and venation; such characters, although often difficult, are usable, but of course the entities should be substantiated by floral differences. The six species which I recognize from Fiji all appear to be endemic; one of them is described as new.

The local name *mathou* is apparently used indiscriminately for the genus in Fiji, and several of the species provide a fragrant bark which is scraped and used to perfume coconut oil.

KEY TO THE SPECIES

Leaf-blades ovate to elliptic or lanceolate, comparatively large, usually more than 9 cm. long and 4.5 cm. broad (or lanceolate if narrower), conspicuously 3(or 5-)-nerved, the secondary basal nerves nearly as prominent as the costa.
Principal nerves diverging from the broadened distal portion of the petiole, the secondary basal nerves usually following the blade-margin for 5–10 mm. and then dividing; leaf-blades usually rounded at base and suddenly decurrent on the petiole, obtuse at apex; petiole 2–2.5 cm. long.....1. *C. pedatinervium.*
Principal nerves slightly concurrent with the costa proximally, or the secondary basal nerves, if diverging from apex of petiole, not following the blade-margin nor emitting important branches; leaf-blades attenuate to obtuse (rarely rounded) at base.
Leaf-blades oblong- or ovate-elliptic, averaging 2–2.5 times as long as broad, the basal secondaries rarely concurrent with the costa for a short distance.

Branchlets of inflorescence copiously tomentellous with pale hairs 0.5–0.7 mm. long; pedicel 2–3 mm. long at anthesis, stout; perianth-segments 2–2.6 mm. long, the 3 inner ones obviously the narrower; stamens 1.8–2 mm. long, the filaments spreading-pilose, the anthers very densely yellow-glandular; staminodes about 1.5 mm. long; leaf-blades acuminate or at least conspicuously cuspidate at apex.....
.....2. *C. pallidum.*

Branchlets of inflorescence essentially glabrous at anthesis, the sericeous indument, if present (as on pedicels), of hairs 0.1–0.2 mm. long; pedicel usually 5–7 mm. long at anthesis, comparatively slender; perianth-segments subequal, 3–4 mm. long; stamens 2.2–3 mm. long, the filaments minutely sericeous-hispidulous, the anthers not conspicuously glandular; staminodes 1.8–2.3 mm. long; leaf-blades obtuse or rounded at apex.....3. *C. leptopus.*

Leaf-blades lanceolate, averaging 3 times as long as broad, attenuate at base, gradually long-acuminate at apex, 3-nerved, the basal secondaries usually concurrent with the costa for 5–15 mm., the lower surface of blades often faintly glaucous and sometimes with a trace of indument (of long, pale, tangled hairs) along the nerves.....4. *C. fitianum.*

Leaf-blades oblong-ovate, comparatively small, 4–8.5 cm. long, 2–4.5 cm. broad, rounded or broadly obtuse at base.

Secondary basal nerves of the leaf-blades inconspicuous, scarcely reaching the middle of the leaf; petiole 3–10 mm. long; bracts and bracteoles of inflorescence persistent, 3–5 mm. long; inflorescence-branches and perianth sericeous.....5. *C. rigidum.*

Secondary basal nerves of the leaf-blades obvious, nearly as prominent as the costa; petiole 13–18 mm. long; bracts and bracteoles of the inflorescence caducous; inflorescence-branches and perianth densely fulvo-lanuginose.....6. *C. Degeneri.*

1. **Cinnamomum pedatinervium** Meissn. in DC. Prodr. 15(1): 15. 1864; Seem. Fl. Vit. 201. *pl. 48* p. p. 1867; Drake, Ill. Fl. Ins. Mar. Pacif. 278. 1892.

DISTRIBUTION: Known with certainty only from the type collection, probably from Kandavu.

(?) KANDAVU: Mt. Mbuke Levu, *Seemann 376* (GH, K in part, NY TYPE).

The type collection is admittedly from more than one plant, Seemann (Fl. Vit. 202) citing it from "Buke Levu" [Mt. Mbuke Levu, on Kandavu] and Voma Peak [near Namosi, Viti Levu]. All of the material of this number is sterile. Part of it is characterized by having comparatively large leaf-blades on long (2–2.5 cm.), distally flattened petioles, the principal veins diverging from the petiole, the lateral basal nerves often widely spreading before again dividing at or near the leaf-margin. The second part of the type number has smaller leaf-blades on short (less than 1 cm. long) petioles, the principal nerves being sometimes concurrent for a short distance or, if separating from the base, not widely divergent.

Meissner's original description is apparently based on the first of these concepts, and the specimen from his herbarium, now deposited at the New York Botanical Garden, is not a mixture; clearly, therefore, the first plant discussed above may be taken as *C. pedatinervium*. This is the plant illustrated at the left of Seemann's *plate 48*. The Kew sheet of *Seemann 376* is a mixture, part of it representing the second plant discussed above and illustrated in the upper right portion of Seemann's *plate 48*, as *fig. 1*.

The short-petioled small-leaved specimen which is the atypical portion of *Seemann 376* may be confidently identified as *C. rigidum* Gillespie. There remains the problem of deciding which portion of *Seemann 376* was obtained on Kandavu and which on Mt. Voma; this cannot be positively stated. However, since *C. rigidum* is known to occur on Mt. Naitarandamu, near Namosi, it is probable that the atypical portion of Seemann's number was the part he obtained on Mt. Vomá. Furthermore, it is significant that the typical material of *C. pedatinervium* cannot, in my opinion, be exactly matched, and that no other specimens of *Cinnamomum* from Kandavu are at hand. It is probable, therefore, that the type locality of the species is Mt. Mbuke Levu on Kandavu; further collections of *Cinnamomum* from this mountain will doubtless clarify the situation.

Seemann cites a specimen of *C. pedatinervium* from the island of Ngau, collected by Berwick; not having seen this specimen, I cannot verify its identity, but it just as likely represents another species of the genus.

As represented by the type material, *C. pedatinervium* differs from the other large-leaved species of the genus in Fiji in the divergence and lateral branching of the basal nerves, as discussed above and as shown in Seemann's plate. Since this material is sterile, inflorescence-characters cannot be utilized, although they may well exist. Gillespie (in Bishop Mus. Bull. 91: 7. 1932), in referring his no. *2718* to *C. pedatinervium*, was aware of the difference in venation but considered it of secondary importance. On the basis of characters mentioned in my key I believe Gillespie's plant to represent a new species, described below as *C. leptopus*.

2. **Cinnamomum pallidum** Gillespie in Bishop Mus. Bull. 91: 6. *fig. 5*. 1932.

DISTRIBUTION: Endemic, known from Viti Levu and probably also occurring on both Ovalau and Vanua Levu; elevations of near sea-level to about 1000 meters have been recorded. The species is a small tree, up to 10 m. in height, occurring in forest.

VITI LEVU: Mba: Tholo-i-Nandarivatu, *Gillespie 3904* (Bish, GH); Serua: Mburetolu, on Taunovo Creek, *B. E. Parham 2857* (A); Naitasiri: Nanduna, Waindina River, *B. E. Parham 1082* (A); Rewa: Mt. Korombamba, *Gillespie 2273* (Bish, GH), *Meebold 16441* (Bish, NY). OVALAU and VANUA LEVU [Mbua: Mbua Bay]: *U. S. Expl. Exped.* (GH 3 sheets, US 40444). Fiji, without definite locality: *Horne 99* (GH TYPE), *867a* (GH).

Of the cited specimens, all are sterile except the two collected by Horne, these demonstrating the conspicuously tomentellous inflorescence which clearly differentiates the species from *C. leptopus*, described below. The sterile specimens cited are referred here because of their acuminate leaf-blades, although identification of sterile material of this and the next species must remain tentative.

3. **Cinnamomum leptopus** sp. nov.

Cinnamomum pedatinervium sensu Gillespie in Bishop Mus. Bull. **91**: 7. *fig. 6.* 1932, non Meissn.

Arbor ad 12 m. alta, ramulis subteretibus gracilibus glabris, juventute haud obscure puberulo-sericeis; petiolis rugulosis supra complanatis 10–20(–25) mm. longis glabris; laminis coriaceis in sicco viridi-olivaceis concoloribus ovato- vel elliptico-lanceolatis, 8–18 cm. longis, 4–10 cm. latis, basi rotundatis vel obtusis et in petiolum decurrentibus, apice obtusis vel rotundatis haud attenuatis, margine leviter incrassatis, utrinque glabris, 3(vel obscure 5-)-nerviis, nervis secundariis principalibus cum costa ad 1 cm. concurrentibus vel e basi orientibus curvatis fere ad apicem adscendentibus utrinque elevatis vel subtus subprominentibus, nervis tertiariis transversis numerosis et rete venularum intricato utrinque prominulis vel subplanis; inflorescentiis subterminalibus diffuse paniculatis ad 20 cm. longis, pedunculis brevibus ramulisque gracilibus sub anthesi subglabris, bracteis bracteolisque mox caducis, pedicellis gracilibus 5–7 mm. longis pilis 0.1–0.2 mm. longis arcte sericeis; perianthio sub anthesi 5–5.5 mm. longo pilis circiter 0.1 mm. longis copiose argenteo-sericeo, tubo intus glabro, segmentis 6 subaequalibus haud carnosis oblongo-lanceolatis 3–4 mm. longis circiter 1.5 mm. latis subacutis intus praesertim basim versus dense sericeis; staminibus 6 exterioribus 2.2–2.4 mm. longis, filamentis ligulatis gracilibus ubique sericeo-hispidulis, antheris oblongis 0.8–1 mm. longis introrse 4-loculatis, staminibus 3 interioribus 2.5–3 mm. longis, filamentis ad 2 mm. longis medium versus glandulas sessiles auriculatas ovoideas circiter 0.7 mm. diametro gerentibus intus glabris, antheris similibus extrorsis; staminodiis 3 clavatis circiter 2 mm. longis, stipite gracili dorso hispidulo, capitulo anguste deltoideo sagittato circiter 0.8 mm. longo; ovario ellipsoideo in stylum gracilem circiter 2 mm. longum attenuato; fructibus immaturis ellipsoideis ad 7 mm. longis, perianthii tubo glabratis, lobis subpersistentibus.

Viti Levu: Mba: Slopes of Mt. Tomanivi [Mt. Victoria], alt. 1000 m., *Gillespie 4084* (Bish); Namosi: Summit of Mt. Voma, alt. 1000 m., Sept. 6, 1927, *Gillespie 2718* (Bish, GH type, NY). Vanua Levu: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., *Smith 6867* (A, US) (tree 8–12 m. high, in patches of forest in open rolling country; leaves and wood aromatic).

The type collection bears flowers and *Smith 6867* young fruits with subpersistent floral parts; *Gillespie 4084* is sterile. The new species is closely related only to *C. pallidum* and cannot, in my opinion, be referred to the immediate relationship of *C. pedatinervium*. It differs from *C.*

pallidum in the characters of inflorescence-indument, flower-size, and leaf-apices mentioned in my key.

It is possible that the Samoan specimens which Christophersen (in Bishop Mus. Bull. 128: 89. 1935) refers to *C. zeylanicum* Bl. are closely related to, or even identical with, *C. leptopus*. Christophersen notes his plant as "a rare escape from cultivation." There is no evidence that the Fijian specimens are non-indigenous, and I do not believe they can be referred to the Malaysian species.

4. **Cinnamomum fitianum** (Meissn.) comb. nov.

Cinnamomum camphoratum var. *fitiana* Meissn. in DC. Prodr. **15**(1): 11. 1864.

DISTRIBUTION: Known from Viti Levu, Vanua Levu, and Taveuni; it occurs in forest or woods at elevations up to about 900 m. In Thakaundrove I noted the species as a tree about 15 m. high, with the name of *mbatho*, a form of the more common *mathou*. For the type specimen the unusual name of *torovoro* was noted.

VITI LEVU: Mba: Vicinity of Nandarivatu. *Gillespie 4154* (Bish, GH), *4205* (Bish). VANUA LEVU: Mbua: Mountains behind Sandalwood [Mbua] Bay, *U. S. Expl. Exped.* (GH 2 sheets); Thakaundrove: Southwestern slope of Mt. Mbatini, *Smith 614* (Bish, NY). TAVEUNI: Vicinity of Wairiki, *Gillespie 4649* (Bish, GH, NY). Fiji, without precise locality: *Milne 260* (K TYPE) ("woods above Nandi," i.e. either Nandi in the present Province of Mba, Viti Levu, or Nandi Bay in southern Mbua Province, Vanua Levu); *Horne 832* (GH).

The cited specimens, all sterile, are distinguished from other Fijian species of this relationship by the comparatively narrow and lanceolate leaf-blades, which are definitely 3-nerved and usually with obviously concurrent principal secondaries. I am unable to refer this plant to any of the other local species, and nothing indicates that it is an introduction. This is the concept which Gillespie, in herbaria, referred to *C. iners* Reinw. ex Bl., but apparently the record for Fiji has not been published. In foliage, only intangible and unsatisfactory characters distinguish the Fijian plant from *C. iners,* which is presumed (cf. Allen in Jour. Arnold Arb. 20: 61. 1939) to have a distribution of Malaysia, Ceylon, and the Malay Peninsula. I raise Meissner's epithet to specific rank in order to obtain a more convenient way of referring to the Fijian entity; if this case parallels others in the family, the collection of flowering material will indicate that our plant is distinct from any Malaysian species.

5. **Cinnamomum rigidum** Gillespie in Bishop Mus. Bull. 91: 7. *fig.* 7. 1932.

Cinnamomum pedatinervium sensu Seem. Fl. Vit. *pl. 48, fig. 1.* 1867, non Meissn.

DISTRIBUTION: Known definitely only from the mountains of Viti Levu, at elevations up to 1200 m., where Gillespie noted it as a small tree in mossy forest; unfortunately the other available specimens lack data.

VITI LEVU: Mba: Mt. Tomanivi [Mt. Victoria], near summit, *Gillespie 4118* (Bish, GH); Namosi: Mt. Naitarandamu, summit, *Gillespie 5103*

(Bish TYPE). Fiji, without precise locality: *Seemann 376* in part (K) (possibly from Mt. Voma, Namosi, Viti Levu; see discussion of *C. pedatinervium*); *U. S. Expl. Exped.* (GH 2 sheets); *Horne 872* (GH), *974* (GH).

Of the cited specimens, only the type is fertile, but the species is well characterized by its small leaves, short petioles, and inconspicuous secondary basal nerves.

6. **Cinnamomum Degeneri** Allen in Sargentia 1: 34. 1942.

DISTRIBUTION: Known only from the type collection.

VITI LEVU: Mba: Nauwanga, vicinity of Nandarivatu, alt. 750 m., *Degener 14531* (A TYPE, Bish, NY, US) (*mathou;* specimen from fallen tree in dense forest).

Although Dr. Allen did not compare this new species with *C. rigidum,* that is probably its closest relative; *C. Degeneri* is amply distinct, however, in its comparatively long-petiolate leaves with prominent secondary basal nerves, and in the more copious indument of its inflorescence-branches and perianth.

2. CRYPTOCARYA R. Br.

Cryptocarya is represented in Fiji by eight species, all apparently endemic; of these, three are here described as new. Throughout the Fijian species the flowers are remarkably consistent in dimensions and indument, so that they provide few characters for specific differentiation. Leaf-venation and type of leaf-pubescence seem to be the most useful and dependable characters, while to a certain extent the fruit-surface and the thickness of the mature perianth-tube are characteristic. The local names *mathou* and *kalinimathou* are commonly used for species of *Cryptocarya,* indicating that the Fijians group it with *Cinnamomum;* both genera have a fragrant bark used for scenting coconut oil.

KEY TO THE SPECIES

Lower surface of leaf-blades glabrous or inconspicuously sericeous (usually evanescently so) with appressed hairs hardly exceeding 0.2 mm. long, not barbellate in nerve-axils.

Leaf-blades lanceolate-oblong, 3–5 times longer than broad, rounded or narrowly cordate at base, pinnate-nerved with 4–6 pairs of secondaries, the margins recurved especially toward base.....1. *C. lancifolia.*

Leaf-blades ovate to elliptic-oblong, usually 2–3 times longer than broad, acute to obtuse (rarely broadly rounded) at base, the margins not conspicuously recurved.

Leaf-blades pinnatinerved, the secondaries 4–8 per side, often curved-ascending but the lower ones hardly longer or more conspicuous than the upper ones.

Perianth-segments within and filaments obscurely sericeous or faintly pilose; fruit at apparent maturity up to 24 mm. long and 15–17 mm. broad, stipitate at base; leaf-blades ovate or oblong-elliptic, 8–20 cm. long, 3.5–11 cm. broad, usually obtuse to rounded (sometimes acute) at base, the secondaries 5–8 per side.....2. *C. fusca.*

Perianth-segments within comparatively densely sericeous; filaments sericeous-hispidulous; apparently mature fruit 10–16 × 8–12 mm., contracted but hardly stipitate at base; leaf-blades ovate or ovate-lanceolate, 5–8(–11) cm. long, 2–5(–6) cm. broad, acute at base, the secondaries 4–6 per side.....3. *C. turbinata.*

Leaf-blades triplinerved or subtriplinerved, the lowermost secondaries very conspicuous, ascending, oriented directly from the petiole or concurrent with the costa to a varying distance (but rarely as much as 2 cm.), the lateral nerves arising from the costa distally 1–4 pairs, comparatively inconspicuous....4. *C. Hornei.*

Lower surface of leaf-blades pilose with spreading hairs usually 0.5 mm. or more long, or similarly pilose at least on costa and secondaries, or conspicuously barbellate in nerve-axils.

Axils of secondary nerves of lower leaf-surfaces not barbellate, essentially no more copiously pilose than the costa, the blades oblong-lanceolate; fruit comparatively smooth, inconspicuously costate or ecostate.

Leaf-blades pinnatinerved, the secondaries 5–7 per side, ascending, the lowermost ones not pronounced, the lower surface uniformly pilose.....5. *C. constricta.*

Leaf-blades subtriplinerved, the lower secondaries sharply ascending, longer and more pronounced than the 2 or 3 pairs arising from the costa distally, the lower surface sometimes glabrescent except for the costa and secondaries.....6. *C. Turrilliana.*

Axils of secondary nerves of lower leaf-surfaces barbellate with obvious tufts of crispate hairs, the blades elliptic or ovate-oblong, pinnatinerved, the secondaries 5–9 per side, subspreading; fruit drying with irregular angles or obviously costate, the perianth-tube much thickened in fruit.

Leaf-blades (7–)9–15 cm. long, 5.5–9.5 cm. broad, broadly obtuse at base, short-cuspidate at apex, essentially glabrous beneath except for the large (4–7 mm. in diameter) barbellate axillary areas, the costa and secondaries leprose-puberulent; fruit irregularly ovoid, drying with conspicuous projecting angles.....7. *C. barbellata.*

Leaf-blades 5–8 cm. long, 2.5–4.5 cm. broad, usually truncate-rounded at base, acuminate at apex, the indument of costa and secondaries beneath comparatively obvious and persistent, the barbellate axillary areas small, usually 1–2 mm. in diameter; fruit subglobose, drying with obvious parallel costae.....8. *C. parinarioides.*

1. **Cryptocarya lancifolia** A. C. Sm. in Bishop Mus. Bull. **141**: 70. *fig. 34.* 1936.

DISTRIBUTION: Endemic and apparently rare, known from Viti Levu and Vanua Levu, in dense bush at elevations of 150–430 m.; the type is from a slender tree 5 m. high.

VITI LEVU: Naitasiri: Nasinu, *Gillespie 3641* (A, Bish, US). VANUA LEVU: Thakaundrove: Yanawai River region, Mt. Kasi, *Smith 1762* (Bish TYPE, GH, NY, US).

Although the Gillespie specimen is sterile, it agrees excellently with the type in the very distinct and characteristic foliage.

2. **Cryptocarya fusca** Gillespie in Bishop Mus. Bull. 91: 8. *fig. 8.* 1932.

DISTRIBUTION: Known only from Viti Levu and Vanua Levu, at elevations of 150–1000 m., usually reported from dense forest. It is said to be a tree, usually 8–20 m. high, with a trunk up to 40 cm. in diameter. Recorded local names are: *kalinimathou* (in central Viti Levu), *kaurivau* or *kaurau* (in Namosi), *vorovoro* (in Mbua), and *karaua* (in Thakaundrove).

VITI LEVU: Mba: Hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6196* (A, US) (perianth brownish yellow); western slopes of Mt. Nanggaranambuluta [Lomalangi], *Smith 6323* (A, US); valley of Nggaliwana Creek, north of the sawmill at Navai, *Smith 5344* (A, US); Nandronga & Navosa: Uluvatu, vicinity of Mbelo, near Vatukarasa, *Tabualewa 15557* (A); Namosi: Vicinity of Namosi, *Gillespie 2624* (Bish TYPE, GH); near Namuamua, *Gillespie 3033* (Bish); Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi [Mt. Victoria] and Nasonggo, *Smith 6105* (A, US); Tamavua woods, near Suva, *Gillespie 2053* (A, Bish, GH); Rewa or Naitasiri: Central Road, Suva, *Mrs. B. H. Tothill 515* (A, Bish). VANUA LEVU: Mbua: Southern slope of Mt. Seatura, *Smith 1610* (Bish, GH, NY, US); Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 536* (Bish, GH, NY, US). Fiji, without definite locality: *Horne 650* (GH).

Although the type collections of *C. fusca* and *C. turbinata* differ quite obviously in foliage, examination of the cited specimens of this relationship indicates that the line between the species is by no means clear cut. In general, the leaves of *C. turbinata* are the smaller and are proportionately narrower. The flowers of *C. turbinata* have a more obvious indument within and the mature fruits seem to be the smaller. However, it is difficult to place some specimens, and the species, in spite of the diversity of the extreme forms, are not entirely satisfactory.

3. **Cryptocarya turbinata** Gillespie in Bishop Mus. Bull. 83: 7. *fig. 5.* 1931.

DISTRIBUTION: Known from Viti Levu, Vanua Levu, and Koro, from a wide range of altitudes (100–1120 m.), occurring in open to dense forest. It is a tree up to 25 m. in height, with a trunk diameter up to 80 cm. Mentioned local names are: *mathou* or *kalinimathou* (in central Viti Levu), *mbatho* (in Mbua, where I noted that the bark is grated and used to scent coconut oil, a use indicated for other Fijian Lauraceae as well), and *lilingi* (on Koro).

VITI LEVU: Mba: Slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, *Gillespie 3915* (Bish TYPE, GH); summit of Mt. Nanggaranambuluta, *Smith 5676* (A, US) (perianth-segments brown, yellow-tinged); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5582* (A, US). VANUA LEVU: Mbua: Southern portion of Seatovo Range, *Smith 1528* (Bish, GH, NY, US); Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6395* (A, US) (fruit jet-black). KORO: Eastern

slope of main ridge, *Smith 954* (Bish, GH, NY, US). Fiji, without definite locality: *Horne 1068* (GH), *1117* (GH).

As remarked above, this entity is not too clearly separable from *C. turbinata*. However, the specimens here cited show less variation in foliage than those cited for the preceding species.

4. **Cryptocarya Hornei** Gillespie in Bishop Mus. Bull. 83: 6. *fig. 4.* 1931.

Cryptocarya Degeneri Allen in Sargentia **1:** 34. 1942.

DISTRIBUTION: Endemic, but apparently the most widespread species of *Cryptocarya* in Fiji, known from several of the islands, at altitudes between sea-level and 900 m. It is reported to be a tree up to 10 m. in height, with a trunk diameter up to 20 cm.; in the Lau Group it grows on limestone soils. Local names are: *matho* (in Ra, where Degener noted that the bark was used to scent coconut oil), *ivi ivi* (on Moala), *wawamunu* (on Vanua Vatu), and *nduvundu* (on Fulanga); the last three names are unexpected in the Lauraceae and their authenticity should be checked.

VITI LEVU: Mba: Mountains near Lautoka [i.e. western slopes of Mt. Evans Range], *Greenwood 904* (A), *1090* (A, Bish, US); vicinity of Nandarivatu, *Degener 14311* (A, Bish, NY, US), *Smith 5049* (A, US); Nandronga & Navosa: Vicinity of Mbelo, near Vatukarasa, *Degener 15228* (A, NY); Ra: Mataimeravula, vicinity of Rewasa, near Vaileka, *Degener 15412* (A TYPE of *C. Degeneri*, Bish, NY, US); Namosi: Mt. Voma, *Gillespie 2893* (Bish, GH, US); Naitasiri: Vicinity of Nasinu, *Gillespie 3491* (Bish). OVALAU: Above Levuka reservoir, *Gillespie 4529* (Bish, GH). VANUA LEVU: Thakaundrove: Natewa Peninsula, hills west of Mbutha Bay, *Smith 808* (Bish, GH, NY, US) (fruit black). MOALA: Near Naroi, *Smith 1317* (Bish, GH, NY, US); on cliff near sea, *Mrs. J. D. Tothill 75* (Bish). VANUA VATU: On limestone slopes, *Bryan 552* (A, Bish). AIWA: Central wooded plateau, *Bryan 523* (Bish). FULANGA: On limestone formation, *Smith 1130* (Bish, GH, NY, US). ONGEA LEVU: Central forest, *Bryan 439* (Bish, US). Fiji, without definite locality: *Horne 170* in part (GH), *171* (GH TYPE), *128* (GH); *U. S. Expl. Exped.* (US 653981); *Seemann 377* (GH).

As represented by the cited specimens, *C. Hornei* seems to be a fairly consistent entity, recognized by its ovate or ovate-lanceolate, obviously triplinerved leaf-blades. In most specimens the principal nerves are oriented from the base, but in others they are concurrent for some distance, rarely as much as 2 cm. The most extreme specimens in this respect are *Greenwood 904* and *1090*, *Smith 5049*, and *Bryan 552*, but these and others show a certain amount of variation in the concurrence of the principal nerves, and I doubt if this character, which is apparently not correlated with others, is significant in this case.

The most careful comparison I can make between the types of *C. Hornei* and *C. Degeneri* discloses no consequential difference in foliage or branchlets. The type of the first is in flower and of the second in fruit, but the indument of the inflorescences is similar, being necessarily sparser in the fruiting specimen.

Seemann (Fl. Vit. 202. 1867) suspected his sterile no. *377* of being an undescribed species and provided a brief diagnosis for it as "*Laurinea*, n. 377," in his notes on the genus *Tetranthera*.

The closest relative of *C. Hornei* seems to be **Cryptocarya elegans** (Reinecke) comb. nov. (*Cinnamomum elegans* Reinecke in Bot. Jahrb. **25:** 633. 1898; Christophersen in Bishop Mus. Bull. **128:** 89. 1935), a Samoan species of which my concept is based on material from Savaii and Upolu (*Reinecke 540a* [US], cited in original description; *Rechinger 1868* [US]; and *Christophersen 2868* [US], cited by Christophersen). These specimens, in flower and fruit, can belong only to *Cryptocarya;* as compared with *C. Hornei,* the Samoan species has larger floral parts and the leaf-blades with more obvious sericeous indument beneath, especially on the principal nerves. However, the two entities are very close, and it should be noted that specimens of *C. Hornei* from Lau have a heavier indument than those from the larger Fijian islands, indicating a transitional population.

5. **Cryptocarya constricta** Allen in Sargentia **1:** 35. 1942.

DISTRIBUTION: Known only from the type collection.

VITI LEVU: Naitasiri: Suva Pumping Station, alt. 30 m., *Degener & Ordonez 13761* (A TYPE, Bish, NY, US).

This very distinct species, known only in fruit, is at once distinguished by its oblong-lanceolate pinnatinerved leaf-blades, which are conspicuously and uniformly pilose beneath. In leaf-shape and -texture it suggests some of the specimens of *C. fusca,* which may be its general relationship, but its status as a species seems unquestionable.

6. **Cryptocarya Turrilliana** sp. nov.

Arbor ad 20 m. alta, ramulis teretibus gracilibus, juventute pilis ferrugineis 0.3–0.7 mm. longis densissime hispidulo-tomentosis, demum canopuberulis et subglabratis; petiolis gracilibus supra canaliculatis 10–25 mm. longis ut ramulis pubescentibus; laminis chartaceis in sicco olivaceo- vel fusco-viridibus saepe subtus pallidioribus, ovato-lanceolatis, 8–18 cm. longis, 3–8.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, superne gradatim acuminatis (acumine ipso 5–15 mm. longo obtuso), margine leviter recurvatis, primo utrinque pilis ferrugineis 0.4–0.7 mm. longis patenti-pubescentibus, indumento subtus saltem costa nervisque principalibus longe persistente supra demum fugacio, subtriplinerviis, nervis secundariis principalibus cum costa ad 2.5 cm. concurrentibus (interdum e basi orientibus) adscendentibus et costa supra acute elevatis subtus prominentibus, nervis tertiariis 4 vel 5 brevibus e nervis secundariis principalibus orientibus ad margines arcuato-patentibus, nervis e costa superne utrinsecus 2 vel 3 utrinque elevatis, rete venularum intricato utrinque prominulo, areolis minutis; inflorescentiis axillaribus ad 5 cm. longis (immaturis) paniculatis multifloris, pedunculo ad 2 cm. longo et rhachi ramulisque pilis 0.3–0.5 mm. longis densissime ferrugineo-hispidulis, bracteis oblongis 2–3 mm. longis extus copiose pubescentibus; floribus

subsessilibus, pedicellis ad 0.5 mm. longis; perianthio sub anthesi 3–3.5 mm. longo extus pilis circiter 0.2 mm. longis dense ferrugineo-hispidulo-sericeo, tubo obconico intus glabro, segmentis 6 subcarnosis sub-orbiculari-ovatis circiter 1.5 mm. longis et 1.3 mm. latis intus obscure argenteo-sericeis; staminibus fertilibus 1–1.2 mm. longis, filamentis ligulatis minute hispidulis, 3 intimis basi utrinque glandulam stipitatam gerentibus, antheris deltoideis 0.6–0.7 mm. longis, 3 intimis extrorsis connectivo producto saepe luteo-glandulosis; staminodiis 3 ovoideo-deltoideis 0.7–0.9 mm. longis subsessilibus acutis dorso parce sericeis; ovario ellipsoideo in stylum gracilem ad 1 mm. longum attenuato; infructescentiis persistenter ferrugineo- vel cano-tomentellis, fructibus paucis nigris subglobosis ad 12 mm. diametro sublevibus haud vel inconspicue costatis apice contractis, calycis tubo extus parce puberulo tenui 0.2–0.4 mm. crasso, segmentis subpersistentibus.

VITI LEVU: Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., *Smith 5520* (A, US) (*lindi thevutheva;* tree 20 m. high, in dense forest). VANUA LEVU: Mathuata: Seanggangga Plateau, in drainage of Korovuli River, vicinity of Natua, alt. 100–200 m., Nov. 28, 1947, *Smith 6731* (A TYPE, US) (tree 10 m. high, in patches of forest in open rolling country; flower-buds pale brown); southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 100–350 m., *Smith 6381* (A, US) (*tumbunivorovoro;* tree 5 m. high, in open forest; fruit jet-black).

The new species shows a relationship to *C. Hornei* in its leaf-venation and to *C. constricta* in its pubescence, but it is clearly distinct from both. Its outstanding characters are the fairly persistent indument of its branchlets, leaves, and inflorescence, and the type of venation. The principal nerves are typically highly concurrent and bear obvious short curved tertiaries on the marginal side. Variation in both indument and venation is apparent among the three cited specimens; the type (in young flower) has the densest tomentum and the most highly concurrent nerves. Number *5520*, in fruit, has the tomentum persistent only on the nerves, the principal ones of which are spreading from the petiole. Number *6381*, also in fruit, is somewhat intermediate in both respects. In spite of this variation I feel that only a single species is represented, and it seems impossible to refer this to any described entity.

It is a pleasure to name the new species in honor of Dr. W. B. Turrill, of the Royal Botanic Gardens, Kew, in recognition of his important study of im Thurn's Fijian collection (in Jour. Linn. Soc. Bot. 43: 15–39. 1915).

7. **Cryptocarya barbellata** sp. nov.

Arbor ad 15 m. alta, ramulis gracilibus fuscis, juventute angulatis ferrugineo-leproso-puberulis demum glabratis; petiolis sat robustis supra complanatis 12–15 mm. longis ut ramulis puberulis; laminis subcoriaceis in sicco viridi-fuscis oblongo-ellipticis, (7–)9–15 cm. longis, 5.5–9.5 cm. latis, basi late obtusis, apice breviter cuspidatis, margine subplanis, supra glabris, subtus costa et secundariis parce leproso-puberulis etiam in axillis

nervorum pilis ferrugineis circiter 1 mm. longis conspicue barbellatis, pinnatinerviis, costa valida supra in sulcula depressa vel subplana subtus prominente, nervis secundariis utrinsecus 5–9 erecto-patentibus leviter curvatis supra paullo depressis subtus elevatis, rete venularum intricato supra immerso vel plano subtus prominulo; inflorescentiis axillaribus anguste paniculatis sub anthesi 2–4 cm. longis paucifloris, pedunculo brevi et rhachi ramulisque inconspicue ferrugineo-puberulis vel minute hispidulis; pedicellis subnullis vel ad 1 mm. longis pilis fusco-aureis 0.1–0.2 mm. longis sericeis; perianthio sub anthesi obovoideo 3–3.5 mm. longo, tubo carnoso extus ut pedicello sericeo intus glabro, segmentis 6 tenuiter carnosis orbiculari-ovatis 1.5–1.8 mm. longis latisque apice rotundatis vel obtusis extus parce intus dense sericeis; staminibus fertilibus circiter 1.4 mm. longis, filamentis ligulatis ubique minute sericeo-hispidulis, 3 intimis basi utrinque glandulam minute stipitatam gerentibus, antheris ovoideo-deltoideis circiter 0.8 mm. longis, 3 intimis loculis extrorso-lateralibus connectivo producto apice truncato; staminodiis 3 cordato-ovoideis circiter 1 mm. longis subsessilibus acutis dorso parce sericeis; ovario ovoideo glabro in stylum teretem circiter 0.8 mm. longum attenuato; fructibus paucis in sicco irregulariter ovoideis ad 2 cm. diametro angulis paucis conspicuis lateraliter praeditis, calycis tubo demum glabro incrassato 0.5–1 mm. crasso, segmentis caducis.

VITI LEVU: Mba: Western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. 850–1000 m., Oct. 2, 1947, *Smith 6319* (A TYPE, US) (tree 15 m. high, in dense forest; flower-buds pale yellowish green).

This species and the following, also new, form a clearly marked group among the Fijian *Cryptocaryae*, marked by their pinnatinerved leaves with conspicuous axillary hair-tufts on the lower surfaces; their fruits have the perianth-tube comparatively thick and either angled or costate in drying. Dimensions and shape of leaf-blades, degree of indument, and fruit-shape readily differentiate the two species.

8. **Cryptocarya parinarioides** sp. nov.

Arbor ad 10 m. alta, ramulis gracilibus subteretibus fuscis, juventute leproso-puberulis etiam pilis patentibus circiter 0.3 mm. longis crispato-pubescentibus demum glabratis lenticellatis; petiolis gracilibus leviter canaliculatis 8–10 mm. longis ut ramulis pilosis; laminis chartaceis in sicco fuscis subtus pallidioribus, ovato-oblongis, 5–8 cm. longis, 2.5–4.5 cm. latis, basi plerumque truncato-rotundatis, apice gradatim acuminatis, margine leviter recurvatis, supra glabris, subtus costa et secundariis ut petiolis pilosis etiam in axillis nervorum pilis circiter 0.5 mm. longis distincte barbellatis, pinnatinerviis, costa supra valde impressa subtus prominente, nervis secundariis utrinsecus 5–8 curvato-patentibus supra paullo impressis subtus elevatis, rete venularum intricato utrinque minute prominulo, areolis minutis; infructescentiis axillaribus ad 6 cm. longis, pedunculo brevi et rhachi ramulisque pilis ad 0.3 mm. longis ferrugineo-tomentellis vel hispidulo-puberulis demum glabratis; fructibus subsessilibus paucis

subglobosis 10–14 mm. diametro conspicue plus minusve 12-costatis, calycis tubo extus glabro rugoso 1.5–2 mm. crasso lenticellato copiose immerso-luteo-glanduloso; florum partibus in fructu subpersistentibus; perianthii segmentis 6 oblongis circiter 1.5 × 1.2 mm. apice rotundatis extus puberulis intus sericeis; staminibus fertilibus 1–1.2 mm. longis, filamentis gracilibus ligulatis parce pilosis, glandulis evanescentibus, antheris ovoideis circiter 0.7 mm. longis, 3 intimis connectivo truncato; staminodiis 3 cordato-ovoideis subsessilibus circiter 0.8 mm. longis.

VITI LEVU: Mba: Vicinity of Nalotawa, eastern base of Mt. Evans Range, alt. 550–600 m., May 15, 1947, *Smith 4451* (A TYPE, US) (*malawaso;* tree 10 m. high, in forest along stream).

The new species is readily distinguished from *C. barbellata,* described above, by its smaller and differently shaped leaf-blades, with more persistent indument on the nerves but with much smaller (although still obvious) axillary hair-tufts, and by its regularly costate fruits. The perianth-tube of *C. parinarioides* in fruit is particularly thick, distinctly ridged without but smooth within; the outer portion is copiously yellow-glandular, while the inner portion is characterized by the presence of coarse stone-cells. The leaves of the new species bear a superficial resemblance to those of *Parinarium insularum* A. Gray, the *sea* of the Fijians.

3. ENDIANDRA R. Br.

Of *Endiandra* I am able to recognize seven species in Fiji, one of them occurring also in Samoa; three species are here described as new. Characters pertaining to leaf-size and shape, indument of leaves and floral parts, and shape of perianth are useful in differentiating the species. It is interesting to note that the Fijians apparently have no native name for this genus, individuals of which seem to occur singly in densely forested areas.

KEY TO THE SPECIES

Perianth-tube subglobose, the segments comparatively small, about 1 mm. long, glabrous within; stamens thick-carnose, angular, with essentially lateral locules, the connective swollen and truncate at apex; leaf-blades usually oblong-lanceolate, (7–)9–18 cm. long, (2.5–)3.5–7 cm. broad.... ..... 1. *E. reticulata.*

Perianth-tube shortly obconical, less conspicuous than the lobes at anthesis; stamens dorsiventrally flattened, with obviously extrorse locules.

Perianth-segments densely tomentellous within at least toward base, the tube densely sericeous within; filaments sericeous or tomentellous at least dorsally.

Lower surface of leaf-blades glabrous or sparsely tomentellous only on nerves or inconspicuously strigillose with hairs about 0.1 mm. long.

Leaf-blades obovate or elliptic, (7–)13–23 cm. long, (5–)6–12.5 cm. broad, with (5–)6–8 secondaries per side, cuspidate or acuminate at apex, drying brownish or dark olivaceous, essentially concolored, glabrous beneath or with a tangled pubescence along the nerves; indument of inflorescence-

branches and pedicels spreading, the hairs weak, crispate; filaments sericeous dorsally, the anthers glabrous.....
.....2. *E. elaeocarpa.*

Leaf-blades broadly elliptic, 7–10 cm. long, 4–8.5 cm. broad, with 3–5 secondaries per side, rounded or retuse at apex, drying brownish, paler beneath, on lower surface inconspicuously but regularly strigillose with minute appressed golden hairs; indument of inflorescence-branches and pedicels strigillose, the hairs appressed; filaments copiously tomentellous on all surfaces, the indument extending to the dorsal surfaces of anthers.....3. *E. Gillespiei.*

Lower surface of leaf-blades densely and uniformly pilose with spreading hairs 0.5 mm. or more long, the blades elliptic-obovate, usually 9–14 × 3.5–6 cm., obtuse or short-cuspidate at apex, the secondaries 4 or 5 per side.....4. *E. trichotosa.*

Perianth-segments glabrous on both sides or very sparsely pilose toward base within, the tube glabrous or faintly puberulent or very minutely sericeous within; filaments glabrous.

Flowers comparatively small, the perianth-segments less than 2 mm. long, the stamens less than 1.5 mm. long; leaf-blades usually glaucous or paler beneath, the veinlet-reticulation comparatively coarse, the ultimate obvious areoles 1 mm. or more across.

Leaf-blades ovate-elliptic, 7–13 cm. long, 4–8 cm. broad, often coriaceous; perianth-segments 1.5-2 mm. long; stamens 1.2–1.5 mm. long.....5. *E. monticola.*

Leaf-blades ovate-lanceolate, 4.5–6 cm. long, 2–3.3 cm. broad, comparatively thin, chartaceous in texture; perianth-segments 0.8–1 mm. long; stamens about 1 mm. long..6. *E. tryphera.*

Flowers comparatively large, the perianth-segments 2.5–3 mm. long, the stamens about 2 mm. long; leaf-blades drying olivaceous, nearly concolored, the veinlet-reticulation finely prominulous, the ultimate obvious areoles 0.2–0.4 mm. across.....7. *E. luteola.*

1. **Endiandra reticulata** Gillespie in Bishop Mus. Bull. 83: 8. *fig.* 7. 1931.

DISTRIBUTION: Endemic, thus far known definitely only from Viti Levu, in forest at elevations of 300–1120 m.; it is reported as a slender tree 5–12 m. high.

VITI LEVU: Mba: Tholo-i-Nandarivatu Mt., *Gillespie 3905* (Bish TYPE, GH); summit of Mt. Nanggaranambuluta [Lomalangi], *Gillespie 4341* (Bish, GH); hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6181* (A, US); hills east of Nandala Creek about 3 miles south of Nandarivatu, *Smith 5950* (A, US); Namosi: Vicinity of Nanggarawai Village, *Gillespie 3220* (Bish); vicinity of Namuamua, 2 miles down Namosi trail, *Gillespie 3073* (Bish). Fiji, without locality: *U. S. Expl. Exped.* (US 653977).

On the basis of perianth and stamen characters, mentioned in my key, this species is very distinct from the other Fijian *Endiandrae;* however, a close relationship should be noted between *E. reticulata* and *E. aneityensis* Guillaumin (in Jour. Arnold Arb. 13: 84. 1932), of the New Hebrides. The

two species are practically indistinguishable in foliage and inflorescence, but the New Hebrides plant has the perianth-segments and filaments slightly narrower and the anther-locules more definitely extrorse.

Fruits of *E. reticulata,* not previously described, are present on my nos. *5950* and *6181* and *Gillespie 3073* and *3220.* They are essentially similar to those of *E. elaeocarpa,* being oblong-cylindric, faintly curved, at maturity dull purple and up to 65 × 27 mm., with a thick rugulose pericarp.

2. **Endiandra elaeocarpa** Gillespie in Bishop Mus. Bull. 83: 7. *fig. 6.* 1931.

Tetranthera elaeocarpa A. Gray ex Seem. Fl. Vit. 202, nomen. 1867; Gillespie in Bishop Mus. Bull. 83: 7, as synonym. 1931.

DISTRIBUTION: Fiji (Viti Levu, Ovalau, and Taveuni) and Samoa (specimens cited from Upolu and Savaii by Christophersen in Bishop Mus. Bull. 128: 92. 1935). In Fiji it has been noted as a tree up to 25 m. in height, occurring in dense forest at elevations of 300–900 m.

VITI LEVU: Mba: Mountains near Lautoka [i.e. western flank of Mt. Evans Range], *Greenwood 941* (A), *1091* (A, Bish, US); Rewa: Southeastern slopes of Mt. Korombamba, *Gillespie 2091* (Bish, GH). OVALAU: *U. S. Expl. Exped.* (GH TYPE). TAVEUNI: Western slope between Somosomo and Wairiki, *Smith 888* (Bish, GH, NY, US). Fiji, without locality: *Horne 199* (GH).

The Samoan specimens cited by Christophersen appear to belong to this concept; variation in foliage and inflorescence in Samoa seems no greater than in the Fijian population, although on the whole the leaves tend to be smaller.

In view of the fairly obvious floral differences between this species and the preceding (*E. reticulata*), it is surprising that one should encounter difficulty in placing fruiting or sterile material, especially as the two type specimens are quite different in general aspect and branchlet-indument. In general, the branchlets of *E. elaeocarpa* have a denser and longer indument, but this may become quite evanescent (although it persists in the type, a fruiting specimen). The leaf-blades of *E. elaeocarpa* tend toward a more obovate (rather than oblong-lanceolate) shape, they usually become brownish rather than olivaceous upon drying, and their veinlet-reticulation in general is a trifle the coarser and sharper. However, these vegetative characters appear nearly useless in distinguishing certain specimens, such as *Gillespie 3073* and *3220,* which he identified as *E. elaeocarpa,* but which appear to me just as likely to belong to *E. reticulata* on the basis of their comparatively small and narrow leaf-blades.

Gillespie indicated the binomial *E. elaeocarpa* as a new combination, but Gray's basonym had not been validly published; therefore the entity should have been treated as a new species and no parenthetical author should be cited.

3. **Endiandra Gillespiei** sp. nov.

Arbor, ramulis gracilibus apicem versus angulatis pilis adpressis aureis

circiter 0.1 mm. longis puberulis vel strigillosis, demum glabrescentibus teretibus fuscis rugulosis; petiolis 10–18 mm. longis rugulosis ut ramulis pilosis supra complanatis vel leviter canaliculatis; laminis chartaceis in sicco supra fuscis subtus pallidioribus saepe glaucis, late ellipticis, 7–10 cm. longis, 4–8.5 cm. latis, basi late obtusis et in petiolum decurrentibus, apice rotundatis vel leviter retusis, margine subplanis, supra glabris, subtus inconspicue sed dense aureo-strigillosis (pilis circiter 0.1 mm. longis), costa supra elevata subtus prominente, nervis secundariis utrinsecus 3–5 arcuato-adscendentibus utrinque elevatis, rete venularum utrinque prominulo; inflorescentiis axillaribus paniculatis plerumque 4–7 cm. longis, pedunculo gracili subtereti 1.5–3 cm. longo et rhachi ramulisque copiose strigillosis (pilis fulvo-cinereis circiter 0.1 mm. longis), ramulis lateralibus 3–7 ad 3 cm. longis plerumque 2–4-floris; pedicellis post anthesin 2–3 mm. longis apice 1- vel 2-bracteolatis, bracteolis oblongo-lanceolatis circiter 0.8 mm. longis extus strigillosis caducis; perianthii tubo obconico extus minute strigilloso intus dense fulvo-sericeo, segmentis 6 aequalibus subcarnosis obscure pellucido-glandulosis oblongis circiter 1.8 × 0.8 mm. apice obtusis, extus puberulis vel glabrescentibus, intus pilis 0.2–0.3 mm. longis dense tomentellis; staminibus 3 circiter 1.3 mm. longis, filamentis ligulatis angustis ubique pilis fulvis 0.2–0.3 mm. longis copiose tomentellis basim versus biglandulosis, antheris deltoideis complanatis circiter 0.7 mm. longis et latis dorso subsericeis, loculis extrorsis, connectivo obtuso; staminodiis sessilibus irregulariter subglobosis circiter 0.5 mm. diametro; ovario subgloboso glabro, stylo tereti circiter 0.7 mm. longo, stigmate minuto.

OVALAU: Along stream above the Levuka reservoir, alt. 550 m., Jan. 30, 1928, *Gillespie 4525* (A, Bish, GH, US 1967775 TYPE).

The species here described is most readily distinguished by the indument of its perianth and filaments, indicating its relationship with *E. elaeocarpa*, from which it differs in the characters of foliage and inflorescence detailed in my key. Superficially it is more suggestive of *E. monticola*, from which it differs not only in its pubescent flowers, but also in the rounded leaf-apex and the more obvious hairs of the lower leaf-surface.

4. **Endiandra trichotosa** sp. nov.

Arbor gracilis ad 12 m. alta, ramulis sat robustis subteretibus ad nodos complanatis, juventute purpurascentibus rugulosis pilis ferrugineis patentibus crispatis circiter 0.5 mm. longis copiose pilosis, demum cinereis glabrescentibus; petiolis robustis 1–2 cm. longis supra complanatis ut ramulis pilosis; laminis chartaceis in sicco utrinque fuscis elliptico-obovatis, (7–)9–14 cm. longis, 3.5–6 cm. latis, basi acutis et in petiolum decurrentibus, apice obtusis vel breviter cuspidatis, margine leviter recurvatis, supra costa interdum hispidula excepta glabris, subtus pilis 0.5–0.7 mm. longis pallide ferrugineis patentibus dense et uniformiter pilosis, costa supra paullo elevata subtus prominente, nervis secundariis utrinsecus 4 vel 5 curvato-adscendentibus marginem versus anastomosantibus supra leviter subtus valde elevatis, rete venularum intricato utrinque

prominulo; inflorescentiis axillaribus paniculatis 1.5–4.5 cm. longis pauciramosis, pedunculo subcomplanato brevi et ramulis copiose crispato-pilosis, bracteis minutis caducis; pedicellis teretibus subnullis vel ad 2 mm. longis pilis 0.2–0.3 mm. longis ferrugineis hispidulo-tomentellis; perianthio sub anthesi campanulato-rotato subcarnoso apice circiter 4 mm. diametro, tubo extus ut pedicello piloso intus dense sericeo, segmentis 6 deltoideis apice obtusis extus subglabris intus saltem basim versus crispato-pilosis, 3 exterioribus 1.8–2 mm. longis 1.6–1.7 mm. latis, 3 interioribus paullo minoribus; staminibus ad 1 mm. longis, filamentis carnosis brevibus latis pilis ferrugineis circiter 0.3 mm. longis ubique crispato-pilosis basi inconspicue biglandulosis, antheris late oblongis 0.4–0.5 mm. longis apice rotundatis, loculis extrorsis; staminodiis 3 obscuris sessilibus subglobosis circiter 0.3 mm. diametro; ovario ovoideo glabro, stylo breviter conico circiter 0.5 mm. longo, stigmate minuto.

VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, alt. 100–250 m., Dec. 4, 1947, *Smith 6825* (A TYPE, US) (slender tree 12 m. high, in dense forest; perianth-segments greenish white).

This very distinct species differs from *E. elaeocarpa,* which is patently its closest relative, in the conspicuous and uniform indument of its lower leaf-surfaces. Its leaf-blades have obtuse or very shortly cuspidate apices and comparatively few secondary nerves.

5. **Endiandra monticola** A. C. Sm. in Bishop Mus. Bull. 141: 71. *fig. 36.* 1936; Allen in Sargentia 1: 35. 1942.

DISTRIBUTION: Endemic, known from Viti Levu, Vanua Levu, and Rambi, at elevations of 30–900 m. It has been noted as a shrub or tree 3–7 m. in height, occurring in hill forest or dry forest on ridges.

VITI LEVU: Naitasiri: Navutu-Nanduna track, *B. E. Parham 3012* (A); vicinity of Nasinu, *Greenwood 1122* (A, Bish); Suva Pumping Station, *Degener & Ordonez 13775* (A). VANUA LEVU: *U. S. Expl. Exped.* (US 653999); Mathuata: Summit ridge of Mt. Numbuiloa, east of Lambasa, *Smith 6491* (A, US); Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, *Smith 563* (Bish TYPE, GH, NY, US). RAMBI: *Horne 434* (GH, US).

This species is less closely related to *E. elaeocarpa* than I originally suggested; it is readily distinguished by leaf-shape and by its essentially glabrous flowers. Young fruits are found on three of the collections; they are typical for the genus, oblong-cylindric, up to 4 × 1 cm. (presumably immature), with a black, rugulose pericarp.

6. **Endiandra tryphera** sp. nov.

Arbor (?), ramulis gracilibus subteretibus praeter partes novellas pilis adpressis aureis circiter 0.1 mm. longis puberulas glabris cinerascentibus; petiolis gracilibus rugulosis 8–12 mm. longis supra leviter canaliculatis glabris vel juventute minute puberulis; laminis chartaceis utrinque glabris siccitate supra fuscis subtus glaucis, ovato-lanceolatis, 4.5–6 cm. longis, 2–3.3 cm. latis, basi acutis vel obtusis et in petiolum anguste decurrentibus, apice subacutis vel obtuse cuspidatis, margine subplanis, costa utrinque

elevata, nervis secundariis utrinsecus 3–5 adscendentibus leviter curvatis cum rete venularum utrinque prominulis; inflorescentiis axillaribus paniculatis sub anthesi 1–2 cm. longis, pedunculo brevi et rhachi gracilibus subteretibus pilis fulvis circiter 0.1 mm. longis parce puberulo-strigillosis, ramulis lateralibus paucis brevibus 1–3-floris, bracteolis lanceolato-oblongis ad 1 mm. longis extus parce strigillosis; pedicellis sub anthesi 1.5–2 mm. longis ut rhachi pilosis; perianthii tubo breviter obconico utrinque glabro, segmentis 6 tenuiter carnosis obscure glandulosis ovato-deltoideis, 0.8–1 mm. longis latisque, obtusis, utrinque glabris vel intus basim versus parce pilosis; staminibus 3 glabris circiter 1 mm. longis, filamentis complanatis angustis basim versus biglandulosis, antheris deltoideis longitudine filamentas aequantibus luteo-glandulosis, loculis extrorsis, connectivo obtuso; staminodiis sessilibus deltoideo-subglobosis circiter 0.4 mm. diametro; ovario ovoideo glabro, stylo breviter conico circiter 0.3 mm. longo, stigmate minuto.

FIJI, without definite locality: *U. S. Expl. Exped.*, in 1840 (US 653997 and 653998 TYPE).

From *E. monticola*, its only close ally, the new species differs obviously in its thin-textured, small leaves and in its small floral parts. Although in the size and shape of its leaves it more nearly resembles *E. luteola*, it differs strikingly from that in leaf-texture and venation and in size of flowers, as pointed out in my key.

7. **Endiandra luteola** A. C. Sm. in Bishop Mus. Bull. **141**: 70. *fig. 35.* 1936.

DISTRIBUTION: Known only from the originally cited material.

TAVEUNI: Western slope, between Somosomo and Wairiki, alt. 300 m., *Smith 763* (Bish TYPE, GH, NY, US). A collection from OVALAU, *Graeffe* (K), which I originally cited, has not been re-examined in connection with the present study.

The comparatively large, strictly glabrous flowers, the small leaves, and the very fine veinlet-reticulation characterize this species.

4. LITSEA Lam.

This large and complex genus is represented in Fiji by 14 species, of which I describe seven as new. The presence or absence of perianth-segments, together with various aspects of foliage and indument, make most of the species readily recognizable. A local name used in a generic sense is *lindi*.

KEY TO THE SPECIES

Flowers without perianth-segments.

Leaf-blades comparatively small, very rarely exceeding 12 × 7 cm., the secondary nerves (including basal ones, which are frequently pronounced) not more than 5 per side; inflorescence comparatively small, the peduncle 3–12 mm. long, the floral bracts 3–5 mm. in diameter; mature fruits not much exceeding 1 cm. in length.

Lower surface of leaf-blades glabrous except for axillary hair-tufts, or inconspicuously scattered-pilose; rachis of inflorescence up to

4 mm. long, the umbels 3–6 per inflorescence; pedicels at anthesis 2–4 mm. long; stamens 12–17 . . . . . 1. *L. Pickeringii.*

Lower surface of leaf-blades pilose with minute scattered hairs, these subappressed or spreading, 0.1–0.2 mm. long; rachis of inflorescence minute, 1–2 mm. long, the umbels 1 or 2 per inflorescence; pedicels at anthesis less than 1 mm. long; stamens 6–9 . . . . . 2. *L. palmatinervia.*

Leaf-blades comparatively large, usually 12–18 × 7–13 cm., the secondary nerves (basal ones not pronounced) usually 6–8 per side; inflorescence large, the peduncle 12–20 mm. long at anthesis, the floral bracts 7–8 mm. in diameter; mature fruits 4 cm. or more long . . . . . 3. *L. magnifolia.*

Flowers with perianth-segments.

Floral bracts usually glabrous, rarely sparsely strigose dorsally; perianth-segments 1–2.2 mm. long at anthesis, glabrous or sparsely sericeous dorsally; leaf-blades comparatively small, only rarely exceeding 10 × 5 cm., the secondary nerves not more than 5 per side (or 6 in sp. no. 7).

Leaf-blades elliptic, usually 3–7 cm. long and 2–3.5 cm. broad, rounded or broadly obtuse at apex, the secondaries curved-ascending; stamens or staminodes 6–9.

Inflorescence, including pedicels and floral parts, strictly glabrous except for a few scattered hairs on perianth and filaments; leaf-blades subcoriaceous, glaucous beneath . . . . . 4. *L. Seemanni.*

Inflorescence noticeably pubescent, the pedicels copiously sericeous, the perianth-segments and filaments sericeous dorsally at least toward base.

Leaf-blades subcoriaceous, concolored; peduncle minutely appressed-puberulent; flowers 6 or 7 per umbel; pedicels 0.7–1.5 mm. long, the pubescence about 0.1 mm. long; perianth-segments ciliolate; longest filaments 1–1.3 mm. long . . . . . 5. *L. Hornei.*

Leaf-blades chartaceous, with comparatively conspicuous venation, glaucous beneath; peduncle glabrous; flowers 4 or 5 per umbel; pedicels about 0.5 mm. long, the pubescence 0.2–0.3 mm. long; perianth-segments eciliate; longest filaments about 0.7 mm. long . . . . 6. *L. Grayana.*

Leaf-blades usually more than 7 cm. long and 3 cm. broad or, if smaller, gradually narrowed distally to an obtusely cuspidate apex; stamens or staminodes 12 or more.

Petioles 2.5–3.5 cm. long; leaf-blades elliptic-oblong, usually 8–10 × 4–4.5 cm., with very fine veinlet-reticulation prominulous on both surfaces; peduncles 12–14 mm. long at anthesis, the floral bracts 4.5–5 mm. in diameter; flowers about 5 per umbel, the pedicel about 1 mm. long; perianth-segments 1.5–2.2 mm. long, glabrous, eciliate . . . . . 7. *L. Richii.*

Petioles usually less than 1.5 cm. long; leaf-blades with the veinlet-reticulation comparatively coarse, often immersed; peduncles not more than 8 mm. long at anthesis, the floral bracts not more than 4 mm. in diameter; flowers 2–4 per

umbel, essentially sessile; perianth-segments not more than 1.5 mm. long, ciliolate and usually sericeous dorsally.

Leaf-blades predominantly lanceolate or narrowly elliptic, usually about 3 times as long as broad, acute at base, and gradually narrowed to an obtuse apex, the lower secondaries often short and obscure.....8. *L. vitiana.*

Leaf-blades predominantly elliptic, usually less than twice as long as broad, often obtuse at base and obtusely cuspidate at apex, the lower secondaries usually obvious and ascending at a slightly sharper angle than the upper ones.....9. *L. montana.*

Floral bracts tomentellous or sericeous dorsally; perianth-segments 1.5–4 mm. long at anthesis, densely sericeous dorsally; leaf-blades usually larger, exceeding 10 cm. in length (except sp. no. 13), the secondary nerves 6 or more per side (fewer in sp. no. 13).

Leaf-blades oblong-elliptic, rounded or faintly retuse at apex, rounded to broadly obtuse at base, glabrous beneath at maturity; perianth-segments apparently always 6.

Rachis of inflorescence 2–6 mm. long, ferruginous-tomentose; petioles 1.5–2.5 cm. long; leaf-blades usually 10–13 × 4–5 cm., the petioles and nerves of lower surface often puberulent when young, the secondary nerves 9–11 per side.....10. *L. Imthurnii.*

Rachis of inflorescence 7–10 mm. long, glabrous; petioles 3–5.5 cm. long; leaf-blades usually 12–19 × 6–9.5 cm., strictly glabrous, the secondary nerves 6–8 per side.....11. *L. burckelloides.*

Leaf-blades ovate, gradually narrowed distally into an obtuse or obtusely cuspidate apex, broadly obtuse to acute at base; perianth-segments sometimes more than 6.

Lower surface of leaf-blades (only rarely less than 10 cm. long) persistently pubescent at least on costa and secondaries, the secondary nerves at least 6 per side; peduncles 7–14 mm. long at anthesis; perianth-segments 6–10, 2.5–4 mm. long; stamens 12–16, the outer filaments up to 4 mm. long..12. *L. mellifera.*

Lower surface of leaf-blades (usually 6–8.5 cm. long) glabrous at maturity, the secondary nerves 4 or 5 per side; peduncles about 5 mm. long at anthesis; perianth-segments 6, not more than 2 mm. long; stamens 9 (sometimes 10–12), the outer filaments about 2 mm. long.....13. *L. Alleniana.*

Flowers not known; leaf-blades elliptic-oblong, usually 7–10 × 3–4.5 cm., copiously short-pilose beneath, pinnate-nerved, with 4 or 5 secondaries per side.....14. *L. mathuatacnsis.*

1. **Litsea Pickeringii** (Seem.) Drake, Ill. Fl. Ins. Mar. Pacif. 278. 1892.

Tetranthera Pickeringii A. Gray ex Seem. Fl. Vit. 203. 1867.

DISTRIBUTION: Endemic, but perhaps the most widely distributed species of the genus in Fiji, often common locally (e.g. on the western slope of Taveuni). It has been reported as a tree (rarely as a shrub) 4–18 m. high, occurring at elevations of 30–900 m. in forest, wooded ravines, thickets, etc. Local names are *kasinga* (on Koro), *lilindi* (on Moala), and *nduvundu vuvula* (on Kambara); it is probably also known as *lindi*, which is more or

less a generic name for *Litsea* in parts of Fiji. The only specimen definitely cited by Seemann is his own no. *378*, from Taveuni. He further notes: "Also collected in Viti by U. S. Expl. Exped."; this record was based upon a communication from Gray (quoted on p. 202 of Flora Vitiensis) stating that the Exploring Expedition plant was identical with *Seemann 378*. Therefore, in spite of the specific epithet and the accredited authorship, I believe that *Seemann 378* must be taken as the type collection.

VITI LEVU: Mba: North of Natalau, near Lautoka, *Degener 14993* (A, Bish, NY, US); Nauwanga, vicinity of Nandarivatu, *Degener 14559* (A, Bish, NY, US); hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, *Smith 5898* (A, US); western and southern slopes of Mt. Tomanivi [Mt. Victoria], *Smith 5306* (A, US); Nandronga & Navosa: Along Singatoka River, *Greenwood 833* (A); Naloka, *B. E. Parham 1411* (A). VANUA LEVU: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, US 40458, 40459). TAVEUNI: Somosomo, *Seemann 378* (TYPE COLL., GH); western slope, between Somosomo and Wairiki, *Smith 723* (Bish, GH, NY, US), *838* (Bish, GH, NY, US); vicinity of Waiyevo, *Gillespie 4653* (Bish, GH, NY, US), *4666* (Bish). KORO: East coast, *Smith 1040* (Bish, GH, NY, US). MOALA: Near Maloku, *Smith 1336* (Bish, GH, NY, US). KAMBARA: Limestone formation, *Smith 1248* (Bish, GH, NY, US). Fiji, without locality: *Horne 290* (GH), *385* (GH).

The type is a sterile specimen, *Seemann 378*, and consequently flowers of *L. Pickeringii* have not been described. The abundant flowering material now available indicates that the species is characterized by the absence of perianth-segments, the comparatively long pedicels, and the numerous (12–17) stamens. Of the Fijian species of *Litsea*, the first three in the present treatment have flowers without perianth-segments, while the remaining species have a distinct perianth. This character, although frequently not usable in the herbarium, appears to be the most basic one in the genus and to permit a natural grouping of species. *Litsea Pickeringii* is further characterized by having its leaf-blades of moderate size, usually pale or glaucous beneath, few-nerved, with usually obviously longer and ascending basal secondaries, and with characteristic hair-tufts in the axils of at least the lower secondaries.

In herbaria the binomial is often accredited to the authorship of (A. Gray) Benth. & Hook. However, the epithet was first published by Seemann as *Tetranthera Pickeringii* "A. Gray in litt. ad auct. sine descript.," and so Seemann should be considered the publishing author, to whom parenthetical reference should be made. Drake del Castillo, in his Illustrationes Florae Insularum Maris Pacifici, attributed innumerable combinations to Bentham & Hooker, citing pages of Genera Plantarum where such combinations were in fact not made. In these cases, of which there are several in *Litsea*, Drake should be considered the authority for the binomial.

2. **Litsea palmatinervia** (Meissn.) Drake, Ill. Fl. Ins. Mar. Pacif. 278. 1892.

Tetranthera palmatinervia Meissn. in DC. Prodr. **15**(1): 191. 1864; Seem. Fl. Vit. 202. *pl. 51*. 1867.

DISTRIBUTION: Known only from Namosi Province, in southern Viti Levu, at altitudes of 350–900 m.; although neither habit nor habitat data are available, the collections are presumably from small trees or shrubs in forested regions. The type is *Seemann 375*, deposited in the Meissner Herbarium at the New York Botanical Garden.

VITI LEVU: Namosi: Trail between Nanggarawai and Saliandrau, *Gillespie 3216* (Bish); vicinity of Namosi, *Gillespie 2828* (A, Bish, GH), *3044* (Bish, GH, NY); Mt. Voma, near summit, *Seemann 375* (GH, K, NY TYPE), *Gillespie 2724* (Bish); vicinity of Namuamua, 2 miles along Namosi trail, *Gillespie 3069* (A, Bish, GH, US).

This small-leaved species is possibly a local, but quite distinct, derivative from the more widespread *L. Pickeringii*, from which it differs in the reduced size and number of inflorescence-parts and its smaller leaf-blades with minute indument on the lower surface. Seemann, following Meissner's description, states: "Calyx 6-partite. Stamens 9 or 12?" However, my observations of type material indicate the complete absence of a perianth and the number of stamens as 6 to 9. Seemann's artist has correctly indicated the lack of a perianth, but I believe that he shows too many stamens, unless there is great variation in this feature.

3. **Litsea magnifolia** Gillespie in Bishop Mus. Bull. 83: 6. *fig. 3*. 1931.

DISTRIBUTION: Endemic, known from scattered localities on Viti Levu, Vanua Levu, and Taveuni, at elevations ranging from near sea-level up to 1200 m. The specimens are from trees (up to 18 m. or more high) in forested regions. The type is *Gillespie 2823*. In the original publication the local names of *wa koro vundi* and *moo ndari* are recorded, but in my observation *wa korovundi* (*wa* = vine) refers on Viti Levu to the genus *Faradaya* (Verbenaceae).

VITI LEVU: Mba: Slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, *Smith 4051* (A, US); Naitasiri-Namosi boundary: Mt. Naitarandamu, *Gillespie 3313* (Bish), *3361* (Bish); Namosi: Mountain ridges in vicinity of Namosi, *Gillespie 2823* (Bish TYPE, GH); slopes of Mt. Voma, *Gillespie 2921* (Bish, GH). VANUA LEVU: Thakaundrove: Savuthuru Mt., near Valethi, Savu Savu Bay region, *Degener & Ordonez 13851* (A, Bish, NY, US). TAVEUNI: Vicinity of Waiyevo, *Gillespie 4783* (Bish, GH, NY, US).

On the basis of its floral characters this very distinct species must be placed as a relative of *L. Pickeringii*, but it is at once distinguished by the large size of its foliage and inflorescence-parts and by the very different venation. Although Gillespie mentions the stamens as "about 12," I have noted them as 14–18 in number in specimens including his no. *4783*, the basis of his floral description.

Christophersen has described a Samoan variety of *L. magnifolia*, which has been carefully considered so that a trinomial might be applied to the Fijian plant if desirable. The Samoan entity is characterized primarily by having its young branchlets and innovations crispate-pilose with reddish hairs 0.2–0.3 mm. long, the indument extending to the petioles and midribs of young leaves. The Fijian specimens of *L. magnifolia* have even the

young branchlets essentially glabrous, while the new parts are minutely sericeous with dull gray or whitish hairs about 0.1 mm. long. It is my observation that in this genus such differences are paralleled by obvious floral distinctions. Since flowers are not yet known for the Samoan plant, a full comparison cannot be made, but I believe that the two entities should not be retained in a single species. Therefore, I propose the new binomial **Litsea samoensis** (Christophersen) comb. nov. (*Litsea magnifolia* var. *samoensis* Christophersen in Bishop Mus. Bull. 128: 89. *fig. 10.* 1935) for the Samoan plant.

4. **Litsea Seemanni** (Meissn.) Drake, Ill. Fl. Ins. Mar. Pacif. 278, as *L. Seemannii.* 1892.

Tetranthera Seemanni Meissn. in DC. Prodr. **15**(1): 192. 1864; Seem. Fl. Vit. 203. *pl. 49.* 1867.

DISTRIBUTION: Known only from the summit of Mt. Voma (alt. about 915 m.), Viti Levu, where it occurs as a small tree up to 7 m. high. The type is *Seeman 374;* Meissner indicates the actual type specimen as "v. s. comm. a cl. inventore." However, no specimen of this collection is found in Meissner's personal herbarium, deposited at the New York Botanical Garden.

VITI LEVU: Namosi: Summit of Mt. Voma, *Seemann 374* (TYPE COLL., GH, K), *Gillespie 2745* (Bish), *B. E. Parham 557* (A), *598* (A).

Litsea Seemanni and the two new species described below form a very compact little group in the genus in Fiji, characterized by small, few-nerved, obtuse leaf-blades, compact foliage and inflorescences, and reduced number of stamens.

5. **Litsea Hornei** sp. nov.

Frutex vel arbor (?), ramulis gracilibus teretibus rugulosis primo purpurascentibus et obscure puberulis mox glabrescentibus cinerascentibusque; foliis ubique glabris, petiolis rugulosis supra complanatis 7–10 mm. longis, laminis subcoriaceis in sicco fuscis concoloribus ellipticis, 4–7 cm. longis, 2–3.5 cm. latis, basi acutis et in petiolum anguste decurrentibus, apice rotundato-obtusis vel paullo emarginatis, margine leviter recurvatis, penninerviis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 3 vel 4 curvato-adscendentibus supra planis subtus paullo elevatis, rete venularum intricato supra subimmerso subtus prominulo; inflorescentiis ♂ axillaribus breviter umbellato-racemosis, rhachi ad 5 mm. longa apice minute ferrugineo-sericea mox glabra, umbellis 2 vel 3, bracteis sub pedunculis oblongis 1–1.5 mm. longis dorso sericeis caducis; pedunculo ad 4 mm. longo pilis brunneis minute adpresso-puberulo, bracteis 4 vel 5 pellucido-glandulosis suborbicularibus 3–4 mm. diametro margine interdum parce ciliolato excepto glabris; umbellis 6- vel 7-floris, pedicellis sub anthesi 0.7–1.5 mm. longis pilis aureis circiter 0.1 mm. longis copiose sericeis; perianthii segmentis 6 submembranaceis pellucido-glandulosis oblongo-lanceolatis circiter 2 mm. longis, obtusis, pilis 0.1–0.2 mm. longis dorso parce sericeis, margine integris ciliolatis; staminibus 9 (interdum 7 vel 8), filamentis exterioribus 1–1.3 mm. longis basim versus dorso

sericeo-strigosis glandulis pellucido-punctatis infra medium praeditis, antheris oblongis 0.8–1 mm. longis.

FIJI: Without definite locality, *Horne 972* (GH TYPE), 1877–78.

The plant here described differs from its close ally, *L. Seemanni,* primarily in the pubescence of its inflorescence-parts, especially the pedicels, and in having its leaf-blades concolored rather than glaucous beneath.

6. **Litsea Grayana** sp. nov.

Tetranthera Seemanni var. *chartacea* A. Gray ex Seem. Fl. Vit. 202, nomen. 1867.

Frutex vel arbor (?), ramulis gracilibus, novellis puberulis purpurascentibus, mox glabris cinereisque; foliis ubique glabris, petiolis supra complanatis 8–15 mm. longis, laminis chartaceis in sicco supra fusco-olivaceis subtus glaucis vel pallidioribus ellipticis, 4.5–8.5 cm. longis, 2–3.5 cm. latis, basi attenuatis et in petiolum longe decurrentibus, apice obtusis vel subrotundatis, margine subplanis, penninerviis, costa supra elevata subtus prominente, nervis secundariis utrinsecus plerumque 3 curvato-adscendentibus (infimis saepe conspicuioribus) utrinque acute elevatis, rete venularum utrinque conspicue prominulo; umbellis ♂ in axillis foliorum distalium solitariis vel 2–4 in inflorescentiam racemosam aggregatis, rhachi ad 4 mm. longa gracili glabra; pedunculo ad 6 mm. longo glabro, bracteis 4 ubique glabris pellucido-glandulosis e basi 3- vel 4-nervatis obovato-suborbicularibus circiter 3.5 mm. diametro; umbellis 4- vel 5-floris, pedicellis sub anthesi circiter 0.5 mm. longis pilis aureis 0.2–0.3 mm. longis copiose sericeis; perianthii segmentis 6 membranaceis pellucido-glandulosis oblongo-lanceolatis circiter 1.5 mm. longis, subacutis, basim versus dorso sericeis, eciliatis; staminibus (raro 5 vel 6) 7–9, filamentis exterioribus circiter 0.7 mm. longis inferne dorso parce strigillosis glandulis pellucido-punctatis infra medium praeditis, antheris 0.7–1 mm. longis.

FIJI: Without definite locality, *U. S. Expl. Exped.* (GH, US 40461 TYPE).

Gray's manuscript name on these specimens, published in a note by Seemann, indicates his awareness of the relationship of the plant, which is certainly very close to *L. Seemanni* but which differs in leaf-texture and inflorescence-indument. From the preceding new species, *L. Hornei,* the Exploring Expedition plant may be distinguished by its thinner leaf-blades with comparatively conspicuous venation and by its smaller floral parts, the minute pedicels having a longer pubescence.

7. **Litsea Richii** sp. nov.

Tetranthera Richii A. Gray ex Seem. Fl. Vit. 202, nomen. 1867.

Frutex vel arbor (?), ramulis gracilibus glabris subteretibus rugulosis, primo purpurascentibus, demum cinereis; foliis ubique glabris (vel petiolis juvenilibus basim versus obscure puberulis), petiolis gracilibus supra complanatis 2.5–3.5 cm. longis, laminis subcoriaceis in sicco utrinque olivaceis elliptico-oblongis, (6–)8–10 cm. longis, (3–)4–4.5 cm. latis, basi

acutis et in petiolum decurrentibus, apice obtuse cuspidatis, margine planis, penninerviis, costa supra paullo subtus valde elevata, nervis secundariis utrinsecus 4–6 subpatentibus utrinque elevatis, rete venularum intricato utrinque praecipue supra valde prominulo; inflorescentiis ♂ axillaribus breviter umbellato-racemosis, rhachi 4–9 mm. longa pilis circiter 0.3 mm. longis pallidis parce pilosa, umbellis 6–8 inferioribus caducis, bracteis sub pedunculis oblongis circiter 1 mm. longis obtusis caducis; pedunculo sub anthesi 12–14 mm. longo ut rhachi piloso, bracteis 4 copiose luteo-glandulosis suborbicularibus 4.5–5 mm. diametro glabris margine scariosis eciliatis; umbellis circiter 5-floris, pedicellis gracilibus sub anthesi circiter 1 mm. longis pilis stramineis circiter 0.3 mm. longis sericeis; perianthii tubo ut pedicello sericeo, segmentis 6 ovato-oblongis 1.5–2.2 mm. longis copiose pellucido-glandulosis, obtusis, glabris, eciliatis; staminibus 12 brevibus, filamentis exterioribus circiter 0.5 mm. longis inferne parce setulosis medium versus minute biglandulosis, antheris oblongis 0.8–1 mm. longis.

FIJI: Without definite locality, *U. S. Expl. Exped.* (GH, US 40460 TYPE).

Following Gray's apparent intention, I name this species for William Rich, one of the botanists on the South Pacific Exploring Expedition. It is a very distinct entity, clearly related to *L. vitiana* and *L. montana*, discussed below, but differing in obvious characters of foliage and inflorescence. The long petioles, very fine veinlet-reticulation, long peduncles, and strictly glabrous perianth-segments distinguish the present species.

8. **Litsea vitiana** (Meissn.) Drake, Ill. Fl. Ins. Mar. Pacif. 278. 1892.
Tetranthera vitiana Meissn. in DC. Prodr. **15**(1): 514. 1864; Seem. Fl. Vit. 203. *pl. 50.* 1867.

DISTRIBUTION: Endemic, known from Viti Levu, Ovalau, and Taveuni, at elevations from near sea-level to 900 m. It is reported as a tree 5–10 m. tall, occurring in forest or woods, sometimes with the local name *lindi*. The type specimen, *Storck 903*, from Ovalau, is stated by Meissner to be in the De Candolle Herbarium.

VITI LEVU: Mba: Vicinity of Nandarivatu, *Gillespie 4170* (Bish, GH, NY, US), *4170.1* (Bish); slopes of the escarpment north of Nandarivatu, *Smith 6058* (A, US); northern slopes of Mt. Namendre, east of Mt. Koromba [Pickering Peak], *Smith 4516* (A, US); Nandronga & Navosa: Southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 1185* (A); Ra: Vicinity of Rewasa, near Vaileka, *Degener 15450* (A), *15457* (A, Bish, NY, US), *15492* (A, Bish, NY, US). OVALAU: Port Kinnaird, *Storck 903* (TYPE COLL., GH, K). TAVEUNI: Mt. Manuka, on western slope between Somosomo and Wairiki, *Smith 777* (Bish, GH, NY, US). Fiji, without locality: *U. S. Expl. Exped.* (GH, US 40456).

Combinations of foliage and floral characters, as pointed out in my key, distinguish this species from other Fijian entities except the more recently described *L. montana*, discussed below.

9. **Litsea montana** Turrill in Jour. Linn. Soc. Bot. 43: 36. 1915.

DISTRIBUTION: Endemic, thus far known from Viti Levu and Taveuni,

at elevations of 450–1200 m. It is said to be a tree 5–20 m. tall, found in forest or dense woods; local names are *lindi* (general) and *thavuwaru* (in Mt. Tomanivi region). The type is *im Thurn 217*.

VITI LEVU: Mba: Nandarivatu, *im Thurn 217* (K TYPE); slopes of the escarpment north of Nandarivatu, *Smith 6288* (A, US); Tholo-i-Nandarivatu Mt., *Gillespie 3900* (Bish, GH, NY); Nandarivatu, road to Waikumbikumbi, *Gillespie 3194* (Bish); western and southern slopes of Mt. Victoria, *Gillespie 4115* (Bish, GH), *Smith 5279* (A, US); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, *Smith 5503* (A, US); southern slopes of Nausori Highlands, above Tumbenasolo, *Greenwood 1186* (A). TAVEUNI: Western slope between Somosomo and Wairiki, *Smith 745* (Bish, GH, NY, US).

The characters utilized in my key to distinguish this entity from *L. vitiana* are far from satisfactory, and it must be admitted that the specimens cited under the two species were identified arbitrarily by the superficial aspect of their foliage. Differences in leaf-proportion are noticeable in the two type collections, but there are many intermediate specimens. It has not been possible to compare floral characters satisfactorily, as most of the available material bears fruits. The type collection of *L. vitiana* bears staminate flowers and *Smith 777* pistillate flowers. The only flowering specimens of *L. montana* are the type and *Smith 745*, both pistillate. From these few collections it is seen that the umbels of *L. vitiana* may have 2, 3, or 4 flowers, whereas those of *L. montana* have only 2 flowers, as far as observed; few as these observations are, they indicate that the character of number of flowers, mentioned by Turrill as a basis for his species, is not reliable. I refrain from reducing *L. montana* to the synonymy of *L. vitiana* at this time, since it is possible that future examination of ample flowering material may indicate a basis for the two species; for the present, however, they are maintained with some skepticism.

10. **Litsea Imthurnii** Turrill in Jour. Linn. Soc. Bot. 43: 35. 1915.

DISTRIBUTION: Known only from the type specimen.

VITI LEVU: Mba: Nandarivatu (alt. about 850 m.), *im Thurn 224* (K TYPE).

It is curious that this excellently marked species has not been recollected, although several botanists have visited Nandarivatu since im Thurn. *Litsea Imthurnii* is readily distinguished by its comparatively large, oblong-elliptic leaf-blades with numerous secondaries and rounded or retuse apices, and by its copiously sericeous floral bracts, pedicels, and perianth-segments. With the three species described below as new, it forms a distinct and unmistakable group in Fiji.

11. **Litsea burckelloides** sp. nov.

Arbor (?), ramulis validis subteretibus, primo purpurascentibus et inconspicue puberulis, mox glabrescentibus; foliis ubique glabris, petiolis validis striato-rugulosis 3–5.5 cm. longis, laminis coriaceis in sicco supra

olivaceo-fuscis subtus brunnescentibus oblongo-ellipticis, (10–)12–19 cm. longis, (5–)6–9.5 cm. latis, basi inaequilateraliter rotundatis vel late obtusis, apice rotundatis vel leviter retusis, margine paullo incrassatis, penninerviis, costa valida supra complanata vel leviter canaliculata subtus prominente, nervis secundariis utrinsecus 6–8 subpatentibus marginem versus abrupte curvatis supra subplanis subtus valde elevatis, rete venularum intricato utrinque prominulo vel supra subimmerso; inflorescentiis ♂ axillaribus umbellato-racemosis, rhachi 7–10 mm. longa nigrescente glabra cicatricibus incrassata, umbellis circiter 6 inferioribus caducis, bracteis sub pedunculis oblongis circiter 1.5 mm. longis dorso sericeis caducis; pedunculo paullo ante anthesim circiter 5 mm. longo pilis pallide ferrugineis 0.2–0.3 mm. longis sericeo glabrescente, bracteis 4 vel 5 papyraceis obscure pellucido-glandulosis suborbicularibus circiter 6 mm. diametro dorso ut pedunculo dense sericeis; umbellis circiter 6-floris, pedicellis brevibus et perianthii tubo pilis circiter 0.2 mm. longis dense sericeis, segmentis 6 pellucido-glandulosis obovato-oblongis ante anthesim circiter 2.5 × 1.5 mm. extus sericeis; staminibus 12–15, filamentis parce pilosis, antheris oblongis circiter 1 mm. longis.

FIJI: Without definite locality, *Horne 733* (GH TYPE), 1877–78.

The species here described is obviously closely related only to *L. Imthurnii,* from which it is readily distinguished by its long petioles and larger, strictly glabrous leaf-blades with fewer secondary nerves. The new species at a first glance does not suggest *Litsea,* but its foliage bears a striking resemblance to that of some Pacific species of *Burckella* (Sapotaceae); hence the specific epithet.

12. **Litsea mellifera** sp. nov.

Tetranthera enneadenia A. Gray ex Seem. Fl. Vit. 202, nomen. 1867.

Arbor ad 35 m. alta, trunco ad 1 m. diametro, ramulis teretibus saepe validis juventute canescenti- vel ferrugineo-tomentellis demum glabrescentibus; petiolis validis 1.5–3.5 cm. longis supra complanatis ut ramulis tomentellis demum glabratis; laminis subcoriaceis in sicco utrinque fusco-viridibus vel subtus pallidioribus ovatis, (8–)10–18 cm. longis, (4.5–)6–14 cm. latis (foliorum juvenilium petiolis ad 6 cm. longis et laminis ad 40 × 19 cm.), basi inaequilateraliter late obtusis et in petiolum breviter decurrentibus, in apicem obtusum vel obtuse cuspidatum gradatim angustatis, margine planis vel leviter recurvatis, supra glabris vel primo costa tomentellis, subtus (praecipue secus costam et nervos) ferrugineo-tomentellis vel puberulis (pilis 0.1–0.3 mm. longis) faciei interdum subglabratis ac etiam secus nervos interdum pilis 0.5–0.8 mm. longis subsetosis, penninerviis, costa valida supra leviter elevata vel subcanaliculata subtus prominente, nervis secundariis utrinsecus 6–8 erecto-patentibus marginem versus curvatis supra planis vel leviter impressis subtus prominentibus nervis tertiariis subparallelibus interconnexis, rete venularum supra intricate prominulo subtus laxiore elevato; inflorescentiis ♂ saepe copiosis axillaribus vel ramulis defoliatis enatis, umbellato-racemosis,

rhachi sub anthesi ad 18 mm. longa cicatricibus incrassata et pedunculis copiose ferrugineo-tomentellis (pilis crispatis 0.1–0.2 mm. longis), umbellis 5–12 inferioribus caducis, bracteis sub pedunculis oblongis 2–3 mm. longis dorso copiose tomentellis caducis; pedunculo sub anthesi 7–14 mm. longo, bracteis 4 vel 5 papyraceis obscure pellucido-glandulosis obovato-suborbicularibus 6–7 mm. diametro ut pedunculo dorso tomentellis; umbellis 5–7-floris, pedicellis 2–3 mm. longis et perianthii tubo pilis circiter 0.3 mm. longis copiose sericeis, segmentis 6–10 membranaceis oblongis 2.5–4 mm. longis 1–2 mm. latis apice rotundatis vel obtusis dorso pilis 0.4–0.6 mm. longis ferrugineis dense strigoso-sericeis; staminibus 12–16 sub anthesi quam perianthii segmentis longioribus, filamentis filiformibus exterioribus ad 4.mm. longis conspicue villosis basim versus biglandulosis, antheris oblongis 1.2–1.5 mm. longis dorso luteo-glandulosis; calyce sub fructu coriaceo cupuliformi apice ad 17 mm. diametro margine undulato-lobato, fructu oblongo-ellipsoideo ad 3 cm. longo et 1.8 cm. lato apice obtuse apiculato.

DISTRIBUTION: Known from scattered localities on Viti Levu, Ovalau, Vanua Levu, and Taveuni, at elevations from near sea-level to about 850 m. Observations pertaining to habit, habitat, and local names are mentioned below. The type is *Smith 4393*.

VITI LEVU: Mba: Slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, alt. 700–800 m., May 14, 1947, *Smith 4393* (A TYPE, US) (*vuruti-moko;* tree 35 m. high, in dense forest, the trunk 1 m. in diameter; inner perianth-segments and stamens white, soon becoming yellowish); slopes of the escarpment north of Nandarivatu, alt. 550–800 m., *Smith 6290* (A, US) (tree 20 m. high, in woods along stream); Ra: Tuvavatu, between Rewasa and Nokonoko, near Vaileka, alt. 50–200 m., *Degener 15369* (A, Bish, NY, US) (*lindi;* tree 10 m. high, in forest); Nandronga & Navosa: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, alt. 300–450 m., *Smith 4576* (A, US) (tree 25 m. high, in dense forest; stamens cream-white); Naitasiri: Raradawai, Wainamo-Wainisavulevu Divide, alt. 850 m., *St. John 18261* (Bish, US) (*linchi lailai;* tree 15 m. high, the trunk 1 m. in diameter; fruit red). OVALAU: *U. S. Expl. Exped.* (GH, US 40457, source of the name *Tetranthera enneadenia*). VANUA LEVU: Mbua: Mbua Bay, *U. S. Expl. Exped.* (GH, with large juvenile leaves); lower Wainunu River valley, alt. 0–200 m., *Smith 1737* (Bish, GH, NY, US) (*kasinga;* tree 18 m. high, in dense forest). TAVEUNI: Above Waiyevo, alt. 300 m., *Gillespie 4735* (Bish) (near rocky stream).

Most of the cited specimens bear staminate inflorescences, but mature fruits are described from *St. John 18261,* while *Smith 6290* bears young fruits. The flowers of this species are very fragrant, and I noticed that bees were attracted in large numbers to such specimens as my nos. *4393* and *4576*. Some of the cited material has been identified as *L. magnifolia,* to which it bears a superficial similarity, but of course the perianth characters and the pubescence immediately distinguish the new species. *Litsea mellifera* is most closely allied to *L. Imthurnii,* from which it differs in very obvious characters of leaf-shape and pubescence, as pointed out in my key.

13. **Litsea Alleniana** sp. nov.

Arbor ad 12 m. alta, ramulis subteretibus glabris (novellis obscure ferrugineo-puberulis) primo purpurascentibus mox cinereis; foliis juventute petiolo et faciei inferiore puberulis mox ubique glabratis, petiolis supra canaliculatis 12–16 mm. longis, laminis subcoriaceis in sicco supra fusco-olivaceis subtus pallidis ovatis, 6–8.5 cm. longis, (3–)4–5 cm. latis, basi inaequilateraliter subacutis et in petiolum decurrentibus, in apicem obtuse cuspidatum angustatis, margine subplanis, penninerviis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 4 vel 5 erecto-patentibus supra leviter subtus conspicue elevatis, rete venularum intricato utrinque prominulo; inflorescentiis ♂ axillaribus vel ramulis defoliatis enatis, umbellato-racemosis, rhachi sub anthesi 5–9 mm. longa cicatricibus incrassata et pedunculis pilis ferrugineis 0.1–0.2 mm. longis dense adpresso-strigosis, bracteis sub pedunculis subcoriaceis oblongis circiter 1.5 mm. longis caducis, umbellis 6–10 inferioribus caducis; pedunculo sub anthesi circiter 5 mm. longo, bracteis 4 papyraceis obscure pellucido-glandulosis suborbicularibus circiter 5 mm. diametro ciliolatis dorso minute sericeo demum exterioribus plus minusve subglabratis; umbellis circiter 5-floris, pedicellis sub anthesi circiter 1.5 mm. longis et perianthii tubo pilis circiter 0.2 mm. longis dense ferrugineo-sericeis, segmentis 6 membranaceis oblongis 1.5–2 mm. longis 1–1.3 mm. latis copiose glandulosis apice rotundatis vel obtusis dorso ut pedicello sericeis; staminibus 9 (interdum 10–12) quam perianthii segmentis longioribus, filamentis exterioribus circiter 2 mm. longis pilis brevibus strigillosis basim versus biglandulosis, antheris oblongis circiter 1.2 mm. longis.

VITI LEVU: Mba: Summit of Mt. Koroyanitu, high point of Mt. Evans Range, alt. 1165–1195 m., May 2, 1947, *Smith 4232* (A TYPE, US) (tree 12 m. high, in dense ridge forest and thickets; filaments white).

This plant is obviously closely related to *L. mellifera*, described above, in comparison with which it is reduced in size of foliage and inflorescence-parts and in number of stamens. Its completely glabrous and comparatively few-nerved leaves, short petioles, and the closer indument of its perianth-segments and filaments further distinguish *L. Alleniana*. On the basis of leaf-size the new species might be sought as a relative of *L. montana*, but differences in inflorescence-pubescence and leaf-texture, venation, etc., show that it is not of this alliance.

It is a privilege to associate the name of this species with that of Dr. Caroline K. Allen, in recognition of her extensive and valuable work on the Lauraceae.

14. **Litsea mathuataensis** sp. nov.

Arbor ad 6 m. alta, ramulis gracilibus teretibus fusco-cinereis apicem versus pilis ferrugineis 0.1–0.2 mm. longis dense hispidulo-tomentellis demum glabratis; petiolis gracilibus subteretibus 10–20 mm. longis ut ramulis pilosis; laminis papyraceis in sicco supra fusco-viridibus subtus glaucis elliptico-oblongis, (5–)7–10 cm. longis, (2.5–)3–4.5 cm. latis, basi

acutis et in petiolum decurrentibus, apice obtuse cuspidatis, margine subplanis, supra glabris, subtus pilis pallidis circiter 0.2 mm. longis suberectis copiose pilosis etiam interdum basim costae versus pilis longioribus stramineis densius indutis, penninerviis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 4 vel 5 adscendentibus leviter curvatis supra planis subtus acute elevatis, rete venularum utrinque prominulo; inflorescentiis non visis; infructescentiis axillaribus breviter umbellato-racemosis, rhachi subnulla vel ad 2 mm. longa ut ramulis pilosa, umbellis sub fructu ut videtur solitariis, pedunculo valido ad 10 mm. longo plerumque puberulo; fructibus 1 vel 2, pedicellis validis ad 5 mm. longis parce puberulis vel glabratis; calyce sub fructu coriaceo cupuliformi apice 6–8 mm. diametro subintegro, fructu oblongo-ellipsoideo ad 17 mm. longo et 8 mm. lato apice obtuse apiculato.

VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, alt. 100–350 m., Oct. 27, 1949, *Smith 6364* (A TYPE, US) (tree 6 m. high, in open forest). Fiji, without locality: *Horne s. n.* (GH).

The cited specimens are in fruit and so cannot be accurately placed within the genus, but they so clearly represent an entity not represented among the species discussed above that I venture to describe them as new. The pubescence of the lower leaf-surface and the branchlets distinguishes *L. mathuataensis* from *L. vitiana,* which is very possibly its closest ally. If perianth-characters should indicate that the new species is related to *L. Pickeringii,* it will be readily differentiated by its pubescence and its distinctly pinnate venation.

5. CASSYTHA L.

1. **Cassytha filiformis** L. Sp. Pl. 35. 1753; Meissn. in DC. Prodr. **15**(1): 255. 1864; Seem. Fl. Vit. 203. 1867; Drake, Ill. Fl. Ins. Mar. Pacif. 279. 1892; Greenwood in Proc. Linn. Soc. **154**: 103. 1943.

DISTRIBUTION: This widespread parasitic herb, found throughout tropical regions, occurs frequently in Fiji at elevations up to about 350 m. It is most abundant in thickets behind beaches or on dry river-banks. A local name is *wa urulangi* (or *wa uruilangi* or other variants).

VITI LEVU: Mba: Shores of Mba River near its mouth, *Smith 4743* (A, US); Serua: Vicinity of Ngaloa, along beach, *Degener 15090* (A, Bish, NY, US); Navua, over shore bushes, *Parks 20362* (Bish). VANUA LEVU: Mbua: Mbua Bay, *U. S. Expl. Exped.* (US 40439); Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6433* (A, US). KAMBARA: *Moore 26* (US). FULANGA: Beach, limestone formation, *Smith 1211* (Bish, GH, NY, US). Fiji, without definite locality: *U. S. Expl. Exped.* (GH); *Seemann 373* (GH); *Horne* (GH).

SPECIES EXCLUDED FROM FIJI

ACTINODAPHNE MULTIFLORA Benth. in Hook. Lond. Jour. Bot. **2**: 230. 1843.

Meissner (in DC. Prodr. **15**(1): 214. 1864) mentions this species as

being from Fiji, apparently on the assumption that the type locality, "Tobie" Island, is in that group. Dr. L. M. Perry informs me that Barclay's locality "Tobie" Island apparently refers to Japen (or Jobi) Island, in Geelvink Bay, New Guinea.

DEPARTMENT OF BOTANY,
U. S. NATIONAL MUSEUM,
SMITHSONIAN INSTITUTION.

NOTES ON NEW GUINEA UMBELLIFERAE[1]

P. BUWALDA[2]

With one text-figure

INCLUDED ORIGINALLY in this study were plants collected by (1) Mr. L. J. Brass (1933 and 1936) in Papua; (2) Mr. L. J. Brass and Dr. E. Meyer-Drees (1938) on the Archbold Expedition to Netherlands New Guinea; (3) Mrs. M. S. Clemens (1936 and 1940) in the Morobe district of Northeast New Guinea; and (4) Prof. R. Kanehira and Dr. S. Hatusima in the Arfak Mts. of Netherlands New Guinea. All these specimens were put at my disposal through the courtesy of the Herbarium of the Arnold Arboretum. Later a set of specimens collected by Mr. C. E. Carr in Papua and deposited at the Rijksherbarium, Leyden, was included.

To make this study more complete, fragments from plants collected in Papua by Mr. H. O. Forbes (1885–1886), Sir W. MacGregor (1894), and Mr. W. E. Armit (1894), were received through the efforts of Mr. A. Jessep, the Director and Government Botanist at the National Herbarium, Melbourne, Australia. The originals from which these fragments were taken are in the National Herbarium at Melbourne, Victoria; the fragments are deposited at the Rijksherbarium at Leyden.

Hydrocotyle javanica Thunb., Diss. Hydrocotyle 3 (no. 17), 6 (descr.), *t.* 1798; Buwalda in Blumea **2**: 122. 1936.

DISTRIBUTION: Southeast and eastern Asia to Solomon Islands, Australia, Tasmania, tropical Africa, Malaysia, sea-level to 2900 m. alt.

NETHERLANDS NEW GUINEA: Arfak Mts., Angi, on edge of forest by Lake Gita, *Kanehira & Hatusima 13449;* Bele River, 18 km. NE. of Lake Habbema, 2200 m. alt., one example on loose wet earth on a landslip, *Brass 11306;* same locality, 2300 m. alt., forest ground plant found frequently in wet hollows, *Brass 11253.*

NORTHEAST NEW GUINEA: Morobe District, Boana, 750–1350 m. alt., *Clemens 41638;* Wantoat (Wantot), 1050–1800 m. alt., flowers dull white, *Clemens 11049;* Wantoat vicinity, 1500–1800 m. alt., *Clemens 11333z;* Matap, 1500–1800 m. alt., herb with white flowers, *Clemens 11311 bis;* Rawlinson Range, 2100–3600 m. alt., inflorescence green, *Clemens 12346;* Ogeramnang, 1740 m. alt., open forest trails, *Clemens 4995;* Tobon, 1650 m. alt., *Clemens 6579.*

PAPUA: Mt. Goudenough, 2610 m. alt., *MacGregor s.n.* in 1895; Boridi, open places, 4700 ft. alt., flowers green, Sept. 29, 1935, *C. E. Carr 14285;* Isuarava, open places, 4500 ft. alt., Feb. 1, 1936, *C. E. Carr 15340;* Isuarava, secondary forest on rock, flowers white, 3500 ft. alt., Feb. 26, 1936, *C. E. Carr 15779.*

[1] Botanical Results of the Richard Archbold Expeditions.

[2] Deceased April 28, 1947.

Among the specimens examined, *Brass 11253*, *Clemens 11333z*, *11311 bis*, *12346* and *6579*, and *Kanehira & Hatusima 13449* are very remarkable by their long-pedicelled flowers; a study of material from all parts of Malaysia proves that such forms are connected by a complete series of transitions with the more common form having sessile or nearly sessile flowers. *Brass 11306* and *Clemens 11049* are small forms that show an approach to *H. sibthorpioides* and are difficult to separate from this species. I consider them as belonging to *H. javanica* when there are more than fifteen fruits in the umbellule.

Hydrocotyle sibthorpioides Lam., Enc. Méth. Bot. 3: 153. 1789; Buwalda in Blumea 2: 128. 1936.

DISTRIBUTION: Tropical Asia, tropical Africa, South America (?), Australia.

NETHERLANDS NEW GUINEA: Arfak Mts., Angi, *Kanchira & Hatusima 13825;* Lake Gita, 1900 m. alt., on edge of forest, *Kanchira & Hatusima 13449;* in open marsh, *Kanchira & Hatusima 13674;* Balim River, 1600 m. alt., creeping in ditches, common, flowers white, *Brass 11790;* Bele River, 18 km. NE. of Lake Habbema, 2200 m. alt., creeping on wet rock in bed of forest stream, *Brass 11307;* Lake Habbema, 3225 m. alt., wet sandy banks of a grassland stream, *Brass 9320;* Lake Habbema, creeping over rock face, *Brass 9473;* Lake Habbema, plentiful amongst grass tussocks of marshy hollows, *Brass 9474;* Lake Habbema, open places at edge of forest, pubescent, *Brass 9545;* 2 km. E. of Wilhelmina-top, 3850 m. alt., on wet limestone near waterfall, flowers violet, *Brass & Meyer-Drees 10349;* 11 km. NE. of Wilhelmina-top, 3400 m. alt., creeping in wet open places along small river, corolla violet, *Brass & Meyer-Drees 9687;* hanging over perpendicular banks of stream to length of 1 m., upper surface of leaves smooth and shining, *Brass & Meyer-Drees 9811;* associated with *9811* on banks of stream, *Brass & Meyer-Drees 9812;* N. slopes of Mt. Wilhelmina, 4050 m. alt., alpine grasslands, carpeting wet rocks, *Brass & Meyer-Drees 10088;* Idenburg River, 15 km. SW. of Bernhard Camp, on wet mossy rocks of a waterfall, *Brass 12390.*

NORTHEAST NEW GUINEA: Morobe District, Upper Camp A, *Clemens 10086R;* Wantoat (Wantot), 1050–1800 m. alt., *Clemens 11086;* Wantoat vicinity, 1500–2100 m. alt., flowers garnet-maroon, *Clemens 11336;* Ogeramnang, *Clemens 6395.*

PAPUA: Lala, creeping on rocks in forest, flowers green, 5500 ft. alt., Dec. 27, 1935, *C. E. Carr 14054.*

The specimens are very variable in respect to leaf incisions; specimens from Malaysia show all grades of intermediate variation.

Hydrocotyle vulgaris Linné, Sp. Pl. 234. 1753; Buwalda in Blumea 2: 133. 1936.

DISTRIBUTION: Europe, North Africa, Australia, apparently not on the Asiatic continent.

NETHERLANDS NEW GUINEA: Arfak Mts., Angi, 1900 m. alt., in open marsh by Lake Giji, *Kanchira & Hatusima 13824.*

From the same region discovered by Gibbs. The specimens collected by Kanehira & Hatusima have petioles up to 17.5 cm. long, inflorescences to 14 cm. long with up to nine whorls of flowers; the fruits are smooth, not beset with reddish warts as in the European form.

Centella asiatica (L.) Urb. in Mart., Fl. Bras. 11(1): *287, t. 78, fig. 1.* 1879; Buwalda in Blumea 2: 134. 1936.

DISTRIBUTION: Tropical and subtropical regions all over the world.

PAPUA: Daru Island, W. Division, completely covers patches of ground on old garden clearings in light rain forest, *Brass 6242;* Lake Daviumbu, Middle Fly River, creeping over leafy ground in damp patches of *Tristania* savannah-forest, *Brass 7538;* Koitaki, open savannah land under grasses, stems and stolons dull red, flowers pale red-purple, 1500 ft. alt., July 20, 1935, *C. E. Carr 12848;* Koitaki, stream bank in the open, 1500 ft. alt., flowers reddish, July 29, 1935, *C. E. Carr 12902.*

Trachymene saniculaefolia Stapf in Hook. Ic. Pl. 24: *t. 2308.* 1894; Buwalda in Blumea 2: 141. 1936.

DISTRIBUTION: Borneo (Mt. Kinabalu); Philippine Isl. (Mindoro, Mt. Halcon); New Guinea (southeastern part, Wharton Range, Mt. Albert Edward, Mt. Scratchley); Australia (N. S. Wales, Jenolan Caves).

NORTHEAST NEW GUINEA: Morobe District, Matap, 1500–1800 m. alt., *Clemens 41152.*

PAPUA: Crest of Owen Stanley Range, *MacGregor s.n.*

In leaf shape the specimens show an approach to *T. novoguineensis,* but the leaf blades are broader than long. The specimen collected by MacGregor was originally identified as a *Hydrocotyle* sp. Most probably it is the *Hydrocotyle azorellacea* F. v. Muell., *nomen,* recorded by F. v. Mueller in Jour. Bot. 31: 324. 1893.

Trachymene novoguineensis Buwalda in Blumea 2: 144, *fig. 2a.* 1936.

DISTRIBUTION: New Guinea (Doorman-top, Wichman Mts., Hubrecht valley, Mt. Scratchley, Owen Stanley Range).

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. alt., banks of a small brook in edge of forest, *Brass 9343;* 2 km. E. of Wilhelmina-top, 3650 m. alt., under small shrubs in grassy places, flowers dark violet, *Brass & Meyer-Drees 10387;* 4 km. NE. of Wilhelmina-top, 3660 m. alt., amongst grass and moss on shores of a lake, *Brass & Meyer-Drees 9985;* 7 km. NE. of Wilhelmina-top, 3720 m. alt., few plants on wet grassland, *Brass & Meyer-Drees 9944;* Mt. Wilhelmina, 3560 m. alt., common in moist grass glades, petioles and inflorescence red, *Brass & Meyer-Drees 10019.*

NORTHEAST NEW GUINEA: Morobe District, Sarawaket, 2400–3900 m. alt., *Clemens 5773* (mixed with *T. adenodes!*).

PAPUA: Mt. Dayman, 2700 m. alt. (summit of the Owen Stanley Range, W. of Goudenough Bay), Jan. 1, 1894, *Armit s.n.*

The specimens *Clemens 5773* and *Armit s.n.* are very small forms. The height varies from 2 to 3 cm.; the petioles are 10–15 mm., the lamina 3–6 × 2.5–6 mm., cuneate, tripartite; peduncles 1.5–2.5 cm.

Trachymene koebrensis (Gibbs) Buwalda in Blumea 2: 146, *fig. 1a.* 1936.

DISTRIBUTION: New Guinea (Arfak Mts., Wilhelmina-top).

NETHERLANDS NEW GUINEA: Arfak Mts., Angi Lake, 2400 m. alt., in open burnt summit plateau between Lake Gita and Lake Giji, height of plant 20–30 cm., flowers white, *Kanehira & Hatusima 13689;* Lake Habbema, 3225 m. alt., sterile limestone slope, abundant on sandy soil rich in peaty matter, habit erect, flowers white with purple tinge, *Brass 9529.*

Kanehira & Hatusima 13689 agrees with the specimens found in the same region by Gibbs, whereon the species was based. *Brass 9592* has finely papillose stems and fruits that are densely beset with scale-like trichomes; in all its other characters it agrees with the plants from the Arfak Mts., and on the same plant there occur densely tuberculate fruits as well as a very few that are entirely smooth.

Trachymene arfakensis (Gibbs) Buwalda in Blumea 2: 154, *fig. 2b.* 1936.

NETHERLANDS NEW GUINEA: Arfak Mts., Angi, in open marsh by Lake Gita, 1900 m. alt., height of plant 60 cm., flowers white, rare, *Kanehira & Hatusima 13489, 13624.*

Both specimens agree well with the type material from the same locality collected by Gibbs.

Trachymene adenodes Buwalda in Blumea 2: 155, *fig. 4a, b.* 1936.

NORTHEAST NEW GUINEA: Morobe District, Sarawaket, *Clemens 5233, 5256, 5773 pro parte.*

This species was described from a fragment in the British Museum collected in the Saruwaged Mts. by Keysser. From the more abundant material now at hand, it appears that the plant has rosettes at the base of ascending stems. In leaf form it resembles *T. arfakensis* but differs in the longer petioles, longer peduncles, and the glandular indumentum of petioles, stems, and peduncles. When more material becomes available, it may prove to be the same as *T. arfakensis.* At present I prefer to keep them apart, as there are no intermediates.

Trachymene papillosa Buwalda in Blumea 2: 157, *fig. 4c, d.* 1936.

NETHERLANDS NEW GUINEA: Balim River, 1600 m. alt., deforested slopes, plentiful in the grass on sandy soil, flowers pink, *Brass 11636;* 20 km. N. of Lake Habbema, 2200 m. alt., abundant amongst bracken on poor sandy soil of formerly cultivated slopes, ascending to 20–30 cm., red-hairy, flowers pink, *Brass 10836;* 11 km. NE. of Wilhelmina-top, 3400 m. alt., on moist sandy slope in edge of subalpine forest, *Brass & Meyer-Drees 9754.*

The original description of *Trachymene papillosa* was based on specimens collected in southwest New Guinea, probably from the Hellwig Mts., 3300–3500 m. alt. Among the specimens mentioned above, *Brass & Meyer-Drees 9754,* collected at 340 m. alt., corresponds exactly with the originals. The other two are somewhat different, although in general appearance they agree with the originals. *Brass 10836* at 2200 m. alt.

is very densely hairy with partly glandular hairs; between the hairs the stem is subpapillose but later becomes glabrous and smooth. *Brass 11636,* at 1600 m. alt., is about 40 cm. high and very much branched from 15 cm. above the base; the stems are sparingly hirsute, more densely so above the leaf insertions and there subpapillose; the leaves are very sparingly hirsute to entirely glabrous, the segments are narrower than in the type specimens.

The pedicels of both plants are suberect to reflexed in fruit, the fruits are smooth. There are a few fruits with a very few tubercles.

Trachymene flabellifolia Buwalda in Fl. Males. ser. 1, 4(2): 124. 1949.

Herba perennis e caudice 7–12 mm. crasso caules ad 31 cm. longi proferentes. Caules e basi ramosi, adscendentes, sulcati vel subangulati, parte inferiore atro-suberoso, scaberulo, parte superiore dense papilloso, pilis ad 1 mm. longis substrigoso hirsuto. Folia singula et in rosulis paucifoliis axillaribus, 5–15 mm. distantia disposita; vagina 2–3 mm. longa, 1.5–2 mm. lata, in petiolum attenuata margine pilis ad 2 mm. longis ciliata; petiolus 6–11 mm. longus, pilis ad 1 mm. longis sparse hirsutus; lamina 10–25 mm. longa, 10–30 mm. lata, flabelliforma, tripartita vel trifida segmentis cuneatis 2–3-partitis ad 2–3-fidis, apice dentibus acutis mucronulatis, margine subincrassato subrecurvo; nervatura utrinque distincta flabellata. Inflorescentiae umbellae simplices foliis oppositae in caulium parte superiore; pedunculus teres, striatus, subpapillosus, 4–5.5 cm. longus, pilis ad 1.5 mm. longis divaricatis sparse hirsutus; bracteae involucrantes ad 11, ad 11 mm. longae, circiter 0.75 mm. latae, oblongae vel lanceolatae acutae, margine piloso-dentatae basi connatae; pedicelli 30–50, tenues, teretes, glaberrimae, exteriores ad 5 mm. longi, interiores breviores, fructiferae paullum auctae divaricatae. Calycis dentes circiter 0.25 mm. longi, acuti; petala 0.75–1 mm. longa, circiter 1 mm. lata, ovata subconcava; stamina 5 filamentis ad 1.25 mm. longis, antheris dorsifixis rotundato-ellipsoideis; styli 2 subfiliformes 1.25–1.5 mm. longi, inflexi. Fructus valde applanatus reniformis, mericarpiis ad 3 mm. longis ad 2.5 mm. latis, jugis intermediis circiter 1 mm. a commissura remotis, stylis paullum auctis coronatus, trichomatibus tuberculiformibus dense vestitus; carpophorum integrum, 1.5–1.75 mm. longum, vix biapiculatum.

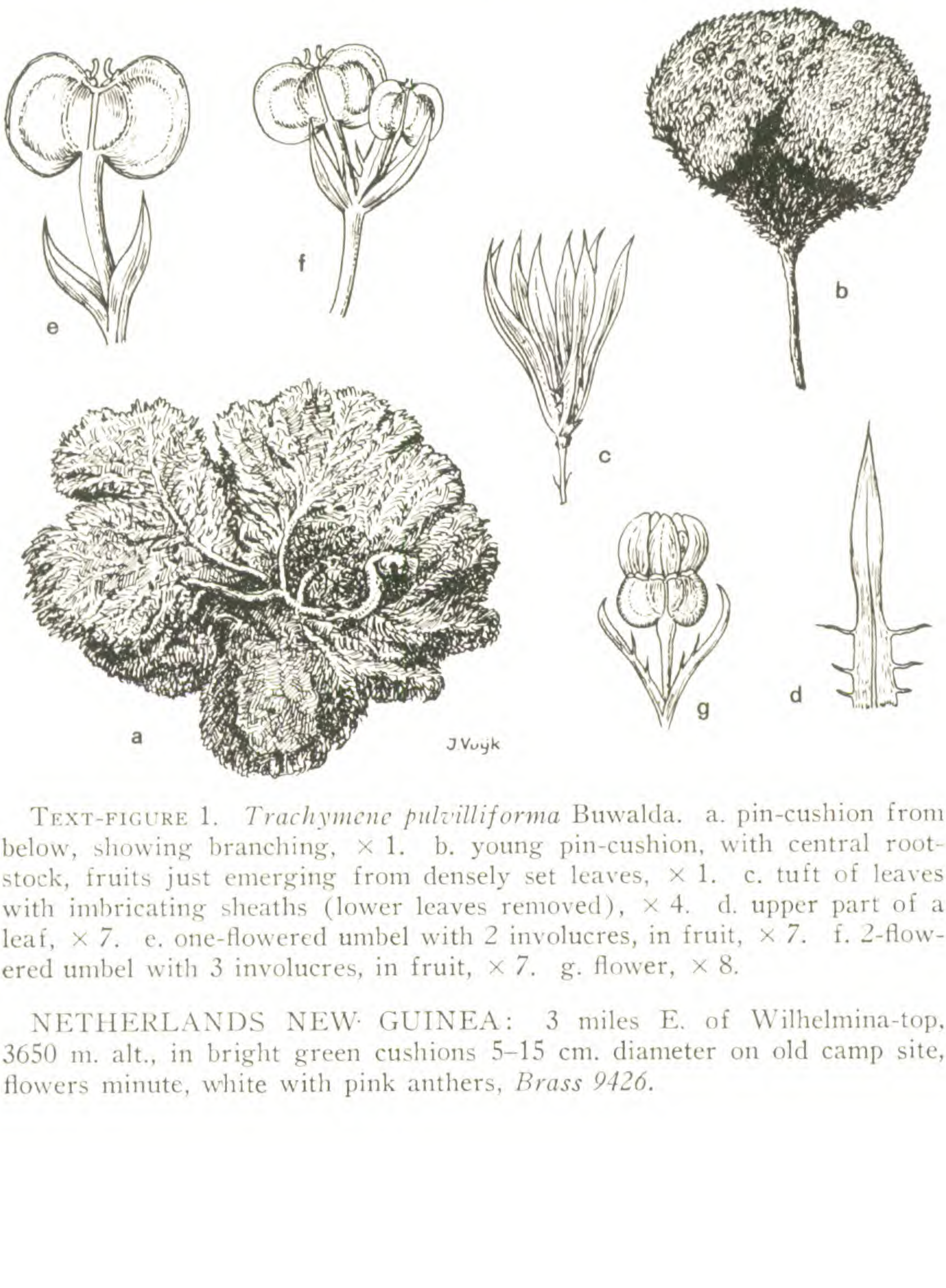
NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. alt., common in mossy glades, *Brass 9586.*

This new species is nearest to *T. papillosa,* from which it differs in its leaves being cuneate to flabelliform.

Trachymene pulvilliforma Buwalda in Fl. Males. ser. 1, 4(2): 125. 1949.

Herba probabiliter perennis, omnino glabra; radix fusiformis ramosa fibrosa; caulis prostratus e basi valde ramosus, rami compacti superiores subadscendentes pulvillum semiglobosum ad 1 cm. altum, 5–15 cm. longum et latum formantes. Folia densissime imbricata apices versus magis minusve in rosulas conferta, parte inferiore semiamplexicaule vaginante; vagina adpressa 1.5–3 mm. longa, 0.5–1 mm. lata lamina versus attenuata;

lamina cochlearis 2–2.5 mm. longa 0.5–0.75 mm. lata apice mucronata uninervata. Inflorescentiae umbellae simplices pauciradiatae ad apices ramorum terminales vel rosulis oppositae, floriferae inter folia absconditae, fructiferae folia paulum superantes; pedunculus planiusculus circiter 2 mm. longus; bracteae involucrantes 2–4, 1.5–2 mm. longae ad 0.5 mm. latae lanceolatae vel spathulato-lanceolatae; pedicelli 1–2 planiusculi circiter 1 mm. longi, fructiferi ad 2.5 mm. longi; calycis dentes inconspicui; petala 5 circiter 1 mm. longa, circiter 0.75 mm. lata; stamina 5 filamentis circiter mm. [sic] longis, antheris dorsifixis rotundato-ellipsoideis; styli 2 subfiliformes circiter 0.5 mm. longi. Fructus glaber valde applanatus reniformis mericarpiis ad 2 mm. longis et ad 1.5 mm. latis, jugis indistinctis, intermediis 0.75 mm. a commissura remotis, stylis paullo auctis coronatus; carpophorum indivisum circiter 1 mm. longum vix biapiculatum.



TEXT-FIGURE 1. *Trachymene pulvilliforma* Buwalda. a. pin-cushion from below, showing branching, × 1. b. young pin-cushion, with central root-stock, fruits just emerging from densely set leaves, × 1. c. tuft of leaves with imbricating sheaths (lower leaves removed), × 4. d. upper part of a leaf, × 7. e. one-flowered umbel with 2 involucres, in fruit, × 7. f. 2-flowered umbel with 3 involucres, in fruit, × 7. g. flower, × 8.

NETHERLANDS NEW GUINEA: 3 miles E. of Wilhelmina-top, 3650 m. alt., in bright green cushions 5–15 cm. diameter on old camp site, flowers minute, white with pink anthers, *Brass 9426*.

This new species differs from all known species of *Trachymene* in the dense mode of growth, the peculiar leaf shape, and the 1–2-pedicelled umbels. In its mode of growth it comes nearest to *T. rosulans* (Danser) Buw.

Oreomyrrhis andicola Hook. f., Fl. Antarct. 2: *288, t. 101.* 1846; Buwalda in Blumea 2: 173. 1936.

DISTRIBUTION: Central and South America from the Falkland Islands, Australia, New Zealand, Malaysia, Borneo (Mt. Kinabalu), New Guinea.

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. alt., locally abundant and covering ground in open bogs, *Brass 9517;* 4 km. NE. of Wilhelmina-top, 3660 m. alt., alpine grassland, small cushions on a mossy rock, flowers white, *Brass & Meyer-Drees 9982;* north slopes of Mt. Wilhelmina, 4000 m. alt., tufted on old grassy screes, *Brass & Meyer-Drees 10083;* same locality, 4150 m. alt., alpine grassland, on dry soil under rocks, petioles and peduncles purple, *Brass & Meyer-Drees 10082;* same locality, alpine grassland, common under rocks, soft gray-green cushions, flowers red, *Brass & Meyer-Drees 10207;* south slope of Mt. Wilhelmina, 4240 m. alt., alpine grassland, cushioned on rocky slopes, plentiful, flowers red, *Brass & Meyer-Drees 10095.*

NORTHEAST NEW GUINEA: Mt. Sarawaket, 4020 m. alt., summit, sheltered nook, uncommon, flowers dark wine, minute, *Clemens 5641.*

Oreomyrrhis andicola was hitherto known only from New Guinea from the Wollaston Expedition, at 3150–3750 m. alt. The rather abundant material collected by Brass provides a good idea of the polymorphy. Mostly the plants are small tufted specimens, sometimes they form soft-haired spreading cushions. *Clemens 5641* is somewhat different, with long-petioled leaves and the peduncles much longer than the leaves.

Oreomyrrhis papuana Buwalda in Blumea 2: 175. 1936.

DISTRIBUTION: New Guinea (Doorman-top, Wilhelmina-top).

NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. alt., common in grass on sandy banks of grassland streams, weak rosette, herb, *Brass 9323;* 11 km. NE. of Wilhelmina-top, 3400 m. alt., in grass on rather dry western slope, corolla violet, *Brass & Meyer-Drees 9708.*

These specimens agree with the material from Doorman-top collected by Lam, whereon the species was based.

Oreomyrrhis azorellacea Buwalda in Fl. Males. ser. 1, 4(*2*): 130, *figs. 7, 8.* 1949.

Herba probabiliter perennis, omnino glabra; caulis suberectus 3–4.5 cm. longus, e basi valde ramosus, ramuli ad 3 cm. longi compacti conferti strictiusculi, superiores gradatim breviores pulvillum densiusculum formantes. Folia densissime imbricata 2–4-fariam, 3–4 mm. longa, parte inferiore amplexicaule vaginante; vagina adpressa ad 1 mm. lata pellucida margine ciliolulata in laminam gradatim attenuata; lamina ad 1.5 mm. longa, ad 1 mm. lata rigidiuscula patula coriacea concava margine submembranacea anthrorso ciliolulata apice obtusa uninervata. Inflorescentiae uniflorae ad caulium ramorum brevium apices, floriferae fructiferaeque

inter folia absconditae. Pedunculus 2 mm. longus subplanus bracteae involucrantes 4 patulae lanceolatae 1.5–2 mm. longae, 0.5–1.25 mm. latae, foliis similes basi connatae. Flores ad 0.5 mm. pedicellati; calycis tubus breve campanulatus lateraliter subcompressus, circiter 1 mm. longus, 1.5 mm. latus, jugis indistinctis; calycis dentes nullae; petala 1 mm. longa, 0.5 mm. lata elliptica acuta uninervata; stamina filamentis circiter 0.5 mm. longis dorsifixis rotundato-ellipsoideis ad 0.5 mm. longis ad mm. [sic] latis; styli 2 conici ad 0.5 mm. longi. Fructus circiter 1.5 mm. longus, 0.75 mm. latus apice subcontractus a latere leviter compressus; juga obtusa aequaliter prominula lateralia ad commissuram, ad apicem fructu confluentia; stylopodium conicum ad 0.5 mm. longum; mericarpium subteres altero nunc abortiente.

PAPUA: Mt. Albert Edward, 3680 m. alt., common on alpine grasslands, tiny vivid green plant in dense pin-cushion masses on grasslands, flowers red, *Brass 4306*.

In mode of growth and inflorescence this plant fallaciously resembles some *Azorella* species. It has, however, a parenchymatous endocarp, the vittae are solitary in the furrows and two at the commissure, the endosperm is furrowed at the commissure in cross-section. According to these characters it must be an *Oreomyrrhis*. In its leaf shape it comes nearest to *O. linearis* Hemsl., but it is much smaller in all its parts.

Oenanthe javanica DC. Prodr. 4: 138. 1830; Buwalda in Blumea 2: 194. 1936.

DISTRIBUTION: Southeastern and eastern Asia, Formosa, Japan, Queensland, Malaysia.

NETHERLANDS NEW GUINEA: 9 km. NE. of Lake Habbema, 2800 m. alt., common on native clearings in the forest, up to 1 m. high, flowers white, *Brass 10701;* Bele River, 18 km. NE. of Lake Habbema, 2200 m. alt., common as a weed in old gardens, native food plant used as a green vegetable, *Brass 11220;* same general locality, very abundant as a weed in old grassy gardens about villages, *Brass 11386;* Balim River, 1600 m. alt., common weed in old grass-grown gardens, flowers white, *Brass 11795*.

NORTHEAST NEW GUINEA: Morobe, Yunzaing vicinity, 1500 m. alt., open wet places, flowers white, *Clemens 3593;* above Ogerannang, 1650 m. alt., wet forest trail, height of plant 15 in., flowers white, fruit green, *Clemens 4435;* Ogerannang, 1620 m. alt., hill trails, *Clemens 4897*.

PAPUA: Koitaki, edges of stream, flowers white, 1500 ft. alt., Apr. 18, 1935, *C. E. Carr 11933;* locality uncertain, *Forbes 885*.

Apium tenuifolium (Moench.) Thell. in Hegi, Ill. Pl. Mitt.-Eur. 5(2): 1140. 1926.

Cnidium tenuifolium Moench. Meth. 98. 1794, excl. syn.

NORTHEAST NEW GUINEA: Morobe, Sattelberg, near house, flower white, not frequent, 3000 ft. alt., Jan. 31, 1936, *Clemens 1720*.

BOTANICAL LABORATORY,
GRONINGEN UNIVERSITY.

NOTES ON XANTHOXYLUM & FAGARA IN CHINA *

JOHN R. REEDER & SHUH-YUEN CHEO

With two plates

ONE OF THE PROBLEMS in the Rutaceae concerns *Xanthoxylum sens. lat.* The genus was first described by Linnaeus in Sp. Pl. 270. 1753. Later (in Syst. Nat. ed. 10, **2**: 897. 1759) he described *Fagara* which he characterized as having both sepals and petals. *Xanthoxylum* (listed on page 1290 of the same work) differs in having only a single perianth whorl. In vegetative characters plants of both genera are very similar. Subsequent authors have failed to agree as to whether one or two genera are represented in this complex. If it were merely a matter of presence or absence of a perianth whorl, then the question is one of personal opinion as to whether such a difference is generic. A more important consideration, it seems to us, is one of the homologies of the perianth of *Xanthoxylum*, i.e. whether it is calyx or corolla. In the absence of anatomical or other concrete evidence it is, perhaps, of some value to consider the arrangement of the floral parts. In *Fagara* the sepals, petals, and stamens are in alternation and in *Xanthoxylum* the perianth divisions alternate with the stamens. It seems to be more common for petals to be lost before sepals in phylogeny and on that basis the perianth of *Xanthoxylum* is calyx. If this be true, the genus could not be derived from *Fagara* since in that

* *Zanthoxylum* L. (Sp. Pl. 270. 1753) was based upon *Z. Clava-herculis* and *Z. trifoliatum* (=*Acanthopanax trifoliatus* (L.) Merr.). Since the latter species is a member of the Araliaceae, the type of the genus is then *Z. Clava-herculis* which has both sepals and petals and is a member of the genus *Fagara* established by Linnaeus (Syst. Nat. ed. 10, 2: 897. 1759) and amplified by Engler (Nat. Pflanzenfam. 3(4): 115. 1896). Rehder (Jour. Arnold Arb. 26: 71–73. 1945) has pointed out a further complication, namely that Duhamel (Traite Arb. Arbust. 1: 229, *pl.* 97. 1755) published the generic name *Fagara* with a description and figure. He states that the perianth is single and that his plant came from Canada. There seems little doubt that his plant was the species later described as *Xanthoxylum americanum* Miller (Gard. Dict. ed. 8. 1768). The publication of *Fagara* Duhamel antedates by four years *Fagara* L. and according to Article 61 of the International Rules this latter must be rejected. Thus the oldest valid name for the genus all post-Linnaean authors have known as *Zanthoxylum* is *Fagara* Duhamel; for *Fagara* L. we must substitute *Zanthoxylum* L. since this latter genus was based upon *Z. Clava-herculis* which has a double perianth.

If, like Rehder, one believes that only one genus is represented here there is no problem. For those who would recognize both genera, however, strict application of the Rules would necessitate essentially a complete reversal in the application of the names as now used, requiring a wholesale transfer of names in both genera. Accordingly Reeder and Cowan have proposed for consideration by the International Botanical Congress that *Xanthoxylum* Miller (type: *X. americanum*) be conserved against *Zanthoxylum* L., and that *Fagara* L. (type: *F. Pterota*) be conserved against *Fagara* Duhamel. In the present paper the names have been used in this sense in anticipation of the adoption of the above proposal.

genus the stamens are opposite the sepals while in *Xanthoxylum* they are alternate with them. On the other hand, if the perianth divisions in *Xanthoxylum* represent petals the arrangement is the same in the two genera.

Engler (in Nat. Pflanzenfam. 3(4): 115. 1896; ed. 2, 19a: 215–216. 1931) apparently considered that the perianth of *Xanthoxylum* must represent calyx for he states that "after long deliberation" he has decided to recognize both genera. He goes on to say, "the flowers of the true *Xanthoxyla* appear to be, with respect to the perianth parts, a very unique type which does not occur otherwise in the family and which cannot be derived from flowers of the Fagara type." *

After studying numerous specimens in this complex, it is our feeling that both these genera are worthy of recognition. Although there are no striking vegetative differences, flowering specimens are quite distinct. Accordingly we are accepting both *Xanthoxylum* and *Fagara,* an interpretation which is, we believe, in harmony with that of most modern students of the group.

The present paper includes the descriptions of two new species and one variety which appear to be new and in addition five new combinations are proposed.

In connection with this study specimens have been seen from the Arnold Arboretum (A), the New York Botanical Garden (NY), and the United States National Herbarium (US), in addition to those in the Herbarium of Yale University (YU). The writers are indebted to the Directors and Curators of institutions who have generously loaned material for this study.

Fagara robiginosa sp. nov.

Arbor 8–9 m. alta; ramis teretibus levibus haud aculeatis, ramulis juvenilibus circiter 2 mm. diametro dense brunneo-tomentosis demum glabratis; gemmis circiter 2 mm. longis ut ramulis tomentosis; foliis deciduis trifoliolatis petiolo 1.5–4 cm. longo incluso 10–20 cm. longis; petiolo petiolisque ut ramulis gemmisque brunneo-tomentosis; foliolis brevissime petiolulatis vel fere sessilibus, laminis in sicco fusco-olivaceis, chartaceis, supra nitidis utrinque glabris sed punctis parvis praeditis, lanceolatis vel elliptico-lanceolatis 5–12 cm. longis 2–4 cm. latis, basi cuneatis et in petiolulum decurrentibus, apice acuminatis, margine leviter crenatis, sinibus glanduliferis 3–5 per centimetrum, costa supra subplana, subtus valde prominente et leviter pubescente, nervis lateralibus principalibus utrinsecus 8–12 adscendentibus supra subplanis, subtus valde elevatis, marginem versus anastomosantibus, rete venularum intricato copioso utrinque prominulo; inflorescentiis terminalibus paniculatis 2–5 cm. longis 1–3 cm. latis, pedunculo 1–2 cm. longo rhachi pedicellisque dense brunneo-tomentosis, pedicellis teretibus circiter 3–7 mm. longis; fructibus immaturis subglobosis rugosis ad 5 mm. diametro, juvenilibus

* Translation from the German of Engler, loc. cit.

dense mox sparsim brunneo-tomentosis, carpellis fere 2, stylo circiter 1 mm. longo, stigmate capitato, sepalis 5, circiter 0.5 mm. longis, floribus ceterum ignotis.

YUNNAN: Ping-pien District, *H. T. Tsai 62186* (A) (tree about 8 meters tall in woods; fruit immature); *62193* (A, TYPE) June 3, 1934 (tree about 9 meters tall in woods, 1 ft. D.B.H.).

This species seems most closely related to *Fagara dimorphophylla* (Hemsl.) Engler in that the branchlets bear the same types of buds and indument. The hairs on this latter species are, however, more sparse and usually light brown or gray, while on *F. robiginosa* the indument is dense and rusty brown in color. The leaves of the new species are quite different being thin and having the margins only weakly crenate, while those of *F. dimorphophylla* are thick and coriaceous and the margins are usually prominently crenate to bluntly serrate.

No flowering specimens were available to us, both the collections cited being in young fruit. We are placing the new species in *Fagara* since small persistent sepals are evident and alternating with them are scars which apparently represent points where petals have fallen.

Fagara dissita (Hemsl.) Engler var. **hispida** var. nov.

A typo differt rhachibus petiolisque dense (non sparse) aculeis recurvis armatis; ramulis crassis densissime spinosis spinis tenuibus rectis.

SZECHUAN: Omei District, *S. S. Chien 5566* (A); Omei Shan, alt. 1500 m., *W. P. Fang 3111* (A, TYPE; NY) August 17, 1928; without precise locality, *F. T. Wang 23269* (A).

Differs from the species in its somewhat longer leaves in which the rachis and petiole are much more densely clothed with recurved prickles, and in the very densely prickled branchlets. The prickles of the branchlets are slender, straight, and up to 8 mm. long.

The following three species prove, upon examination of the flowers, to belong to the genus *Fagara*. The appropriate combinations are accordingly made below.

Fagara mollis (Rehder) comb. nov.

Xanthoxylum molle Rehder apud Rehder & Wilson in Jour. Arnold Arb. **8:** 150. 1927.

Fagara oxyphylla (Edgew.) comb. nov.

Xanthoxylum oxyphyllum Edgew. in Trans. Linn. Soc. **20:** 42. 1846.

Fagara rhetsoides (Drake) comb. nov.

Xanthoxylum rhetsoides Drake in Jour. de Bot. **6:** 275. 1892.
Evodia odorata Léveillé in Repert. Sp. Nov. **9:** 458. 1911.
Xanthoxylum odoratum (Léveillé) Léveillé in Repert. Sp. Nov. **13:** 266. 1914.
Fagara gigantea Hand.-Mzt. in Anzeig. Akad. Wiss. Wien Math.-Naturw. Kl. **58:** 64. 1921.
Xanthoxylum giganteum (Hand.-Mzt.) Rehder apud Rehder & Wilson in Jour. Arnold Arb. **8:** 151. 1927.
Fagara odorata (Léveillé) Hand.-Mzt., Symbolae Sinicae **7:** 623. 1933.

The remainder of this paper is concerned with *Xanthoxylum sensu strictiore*. This is *Xanthoxylum* sensu Engler (loc. cit.) and comprises that part of the Xanthoxylum-Fagara complex in which the flowers bear only a single perianth whorl.

Xanthoxylum arenosum sp. nov.

Frutex sparsim aculeatus, ramis juventute subteretibus sparsim puberulis demum glabratis, aculeis stipularibus complanatis vel subteretibus circiter 1–2 mm. longis, basim versus valde dilatatis; foliis deciduis trifoliolatis petiolo 2–5 cm. longo incluso 10–20 cm. longis, petiolis glabris anguste alatis basim versus canaliculatis, foliolis brevissime petiolulatis vel fere sessilibus, laminis chartaceis vel subcoriaceis, oblongis vel ellipticis 5–10 cm. longis 3–5 cm. latis, in sicco supra fusco-viridibus, subtus pallidioribus, apice obtusis vel acutis saepe mucronatis, basi obtusis vel cuneatis, marginibus integris vel leviter crenatis, costa supra plerumque subplana subtus valde prominente, nervis lateralibus principalibus utrinsecus circiter 10–14, supra subplanis vel subcanaliculatis, subtus elevatis, marginem versus anastomosantibus, venulis immersis vel subprominulis; inflorescentiis terminalibus et axillaribus paniculatis, 3–5 cm. longis 1–2 cm. latis, pedunculo rhachi pedicellisque puberulis, pedicellis teretibus circiter 1.5–3 mm. longis; fructibus rubris (ex coll.) immaturis subglobosis rugosis 1–2 mm. diametro, stylo brevissimo vel nullo, stigmate capitato; carpellis fere 4, sepalis 6–8, anguste lanceolatis circiter 1 mm. longis 0.2–0.3 mm. latis, floribus ceterum ignotis.

HUNAN: Yi Chang District, P'ing T'ou Wan Village, *W. T. Tsang 23719* (US, TYPE; A), May 1–13, 1943 (fairly common on dry sandy soil; shrub, fruit red).

The new species is apparently closely related to *Xanthoxylum alatum* Roxb. from which it differs in its longer leaflets which are oblong to elliptic rather than lanceolate, and in the petiole which is much more narrowly winged. A more important difference is seen in the flowers which commonly bear 4 carpels which have sessile or nearly sessile stigmas. The flowers of *X. alatum* bear only 2 carpels and these have well developed styles.

Xanthoxylum simulans Hance var. **imperforatum** (Franchet) comb. nov.

Xanthoxylum Bungei Planch. var. *imperforatum* Franchet in Mém. Soc. Sci. Nat. Cherbourg **24:** 205. 1884.

Xanthoxylum usitatum Diels in Notes Bot. Gard. Edinburgh **5:** 280. 1912.

Rehder (in Jour. Arnold Arb. 7: 181. 1926) has called attention to the fact that *Xanthoxylum Bungei* Planch. is a nomen nudum and must be replaced by *X. simulans* Hance. He considered, however, that *X. Bungei* var. *imperforatum* was merely a synonym. Our study reveals that two groups may be distinguished here. Our attention was first called to this fact when the junior author, not knowing at the time that *X. Bungei* was invalid, segregated plants into two groups part of which he called *X. Bungei* and the rest *X. simulans*. When it became apparent that

X. Bungei was untenable, a search was made through the literature for a name that might apply to the group of specimens which were like *X. simulans* but differed in a few minor characters. Franchet's var. *imperforatum* seemed to apply and the above transfer is accordingly necessary.

True *X. simulans*, as we understand it, has the leaflets conspicuously dotted and the margins are without glands. The upper surfaces of the leaflets are sometimes scabrous-hispid. Variety *imperforatum*, on the other hand, has the surfaces of the leaflets devoid or nearly devoid of dots and there are prominent glands along the margins of the leaflets in the sinuses of the crenations. Superficially the species and the variety look much alike, but may be readily distinguished by the characters mentioned above.

Xanthoxylum acanthopodium DC. var. **deminutum** (Rehder) comb. nov.

Xanthoxylum dimorphophyllum Hemsl. var. *deminutum* Rehder in Jour. Arnold Arb. **22:** 577. 1941.

SZECHUAN: between Knapi and Tatiaoko, alt. 2600 m. (cited in original description), *C. Schneider 1353* (A); Yen-Yuen District, *infra castellum Kwapi*, vicinity of Otang, alt. 2375 m., *Handel-Mazzetti 482 = 2524* (A).

YUNNAN: Kun-Ming, Tai Pu Chi, Mou Ko Sze, *Y. Tsiang 16493* (type coll. of *X. dimorphophyllum* var. *deminutum*) (photograph and fragment, A).

Although originally described as a variety of *Xanthoxylum dimorphophyllum* it differs from that species in its much smaller, thinner leaves, more compact inflorescences, more slender spines which are present only as stipular pairs, in the densely puberulent twigs, and the smaller fruits. Although Rehder states that the Schneider specimen is in young fruit, re-examination shows that toward the lower part of the specimen there are fruits which are mature and have dehisced. The mature fruits of *X. dimorphophyllum* are 5–6 mm. in diameter, while those of var. *deminutum* are only 3–3.5 mm.

The affinities of this variety are obviously with *X. acanthopodium* which has the same type of compact inflorescence and similar leaves, the latter being thin and having winged petioles. The chief differences are found in the number of leaflets which is predominately 3 in the variety and 5-many in the species, and in the mature fruits which average about 1 mm. smaller in diameter in the variety.

Osborn Botanical Laboratory,
Yale University,
and
University of Nanking,
Nanking, China.

EXPLANATION OF PLATES

PLATE I.

Fagara robiginosa Reeder & Cheo (*H. T. Tsai 62193*) : photograph of type specimen, × ½; drawing of immature fruits, × 5.

PLATE II.

Xanthoxylum arenosum Reeder & Cheo (*W. T. Tsang 23719*) : photograph of type specimen, × ½; drawing of immature fruits, × 5.

FAGARA ROBIGINOSA REEDER & CHEO

XANTHOXYLUM ARENOSUM REEDER & CHEO

TATEA F. MUELLER (PYGMAEOPREMNA MERRILL) AND PREMNA LINNAEUS

E. D. Merrill

In 1883 *Tatea* F. Mueller was described as a monotypic genus based on two collections from Arnheim's Land, northern Australia. In Briquet's treatment of the Verbenaceae, Engler & Prantl Nat. Pflanzenfam. IV (3a): 149. 1895, following Baillon's interpretation of the genus, he placed *Tatea* F. Muell. in the Verbenoideae-Lantaneae next to *Lantana* Linn. He stated, however, that he was not certain that this indicated alliance was correct. This erroneous disposition of *Tatea* was probably one reason why that genus was not considered by me as a possibility, in 1910, when I proposed and described *Pygmaeopremna* Merr. to take a greatly dwarfed Philippine species that I had originally placed in the herbarium as *Premna*. What I assumed to be a distinct genus was placed next to *Premna* Linn. in the Viticoideae-Viticeae, which is manifestly correct; this is also the alliance of *Tatea* F. Muell. (= *Pygmaeopremna* Merr.), as F. Mueller correctly surmised and as Junell's [1] recent morphological study indicates.

Doctor Lam [2] in 1919 recognized *Pygmaeopremna* Merr. as valid, but in the Lam and Bakhuizen van den Brink [3] supplementary work on the Malaysian Verbenaceae in 1921, they expressed the opinion, in which I concur, that *Pygmaeopremna* Merr. could not be distinguished from *Premna* Linn.; but they erred in reducing *Pygmaeopremna humilis* Merr. to *Premna timoriana* Decne., of Timor, as the latter is a shrub several meters high. In 1923, I not only accepted this reduction of *Pygmaeopremna* Merr., but also reduced its type species to the Indian *Premna herbacea* Roxb. I still feel that this disposition of *Pygmaeopremna humilis* Merr. is correct, in spite of the 2-celled ovaries of *Tatea* F. Muell. and of *Pygmaeopremna* Merr. as compared with the conventional 4-celled ones of *Premna* Linn.; but the ovary cells of true *Premna* species vary from two to four, hence this character does not hold as a differential one.

Junell in 1934, in connection with his morphological work on the ovary characters of various genera of the Verbenaceae and the Labiatae, had an opportunity of examining material representing what he took to be three species of *Tatea* F. Muell., including specimens of *T. acaulis* F. Muell. sent to Kew by F. Mueller, authentic specimens representing

[1] Junell, S. Zur Gynäcaeummorphologie und Systematik der Verbenaceen und Labiateen. Symb. Bot. Upsal. 1(4): 1–219. *pl. 1–8, fig. 1–253.* 1934 (p. 85).

[2] Lam, H. J. The Verbenaceae of the Malayan Archipelago Together with Those from the Malayan Peninsula, the Philippines, the Bismarck-Archipelago, and the Palaw, Marianne and Caroline Islands. 1–370. *pl. 1–3.* 1919 (p. 160).

[3] Lam, H. J. & Bakhuizen van den Brink, R. C. Revision of the Verbenaceae of the Dutch East-Indies and Surrounding Countries. Bull. Jard. Bot. Buitenz. III. 3: 1–116. i-iii. 1921 (p. 37).

Pygmaeopremna humilis Merr., which I had sent to Kew, and various Indian collections representing *Premna herbacea* Roxb. He overlooked what is apparently another representative of the group, *Premna nana* Coll. & Hemsl., Jour. Linn. Soc. Bot. 28: 109. 1890, which was based on specimens from the Shan hills in Burma, but which is now also known from Siam.

I agree with Junell that a natural group is represented by the several species, whether it be maintained as a distinct genus or placed as a minor category, distinguishable chiefly by growth form, under *Premna* Linn. He decided that *Pygmaeopremna* Merr. (1910) was congeneric with *Tatea* F. Muell. (1883) which I accept, but because of priority he selected F. Mueller's generic name to take the three species that he briefly considered. He apparently did not realize that, under the accepted rules of nomenclature, the verbenaceous *Tatea* F. Muell. (1883) was invalidated by the earlier rubiaceous *Tatea* Seemann (1866), for it does not matter that the latter is a synonym of the earlier *Bikkia* Reinwardt. Under the provisions of the Code, if one wishes to maintain this little group as one worthy of generic rank, then *Pygmaeopremna* Merr. is the correct generic name.

I still consider that *Tatea* F. Muell. (non Seemann) = *Pygmaeopremna* Merr. is but a greatly dwarfed form of *Premna* Linn. and in this discussion reduce both to the latter genus. In reconsidering all characters of these dwarf species, and comparing these characters with the corresponding ones of the scandent species, the erect shrubs, and the small trees, I conclude that it would be perhaps as logical to segregate the scandent species of *Premna* from the erect ones, which no taxonomist has ever suggested, as it is to attempt to maintain the dwarfed forms here discussed as representing a separate genus. It seems to me that the only differential character that really holds is the actual dwarfing due to habitat, and I am not now willing to recognize a genus that can be maintained only on a habit difference. I must confess that in reaching this conclusion I have been distinctly more influenced by the opinions of thoroughly competent taxonomists, including Schauer, C. B. Clarke, Lam, Craib, Dop, and others, than by the latest morphological findings in this case. Junell should, however, be given credit for recognizing that *Pygmaeopremna* Merr. was, indeed, the same as *Tatea* F. Muell., for this finding represents a distinct contribution. I merely differ in that I believe that both must be reduced to *Premna* Linn.; but if one elects to maintain the group as distinct then *Pygmaeopremna* Merr. will replace *Tatea* F. Mueller.

While here I have tentatively recognized the Australian species as distinct, I am by no means certain that this will prove to be the case when it is possible to make really critical comparisons of representative Asiatic and Australian collections of *Premna herbacea* Roxb. and *Tatea acaulis* F. Muell. With specimens before me from India, Burma, Indo-China, Hainan, the Philippines, and, at last, a single collection from the Netherlands East Indies (Sumba), I am impressed with the close resemblances,

in general, of all of these specimens. Although a morphological study may have indicated characters which induced Junell to retain *Tatea* F. Muell. as worthy of generic rank, with *Pygmaeopremna* Merr. as a synonym, a critical taxonomic study of the several "species" was apparently not made; as he was studying essentially the morphology of the ovary, it is suspected that he over-stressed the 2-celled character. I am satisfied to interpret Roxburgh's species as one having a natural wide geographic distribution, adapted to a peculiarly restricted habitat, and included in it I still retain the Philippine form that I described as new in 1910, as a synonym. In view of the fact that this dwarf species has now shown up in Sumba, south of Flores in the Lesser Sunda Islands, which, from a geographic standpoint, is closer to Arnheim's Land than is, for instance, Northern Luzon to Hainan, I should not be surprised if F. Mueller's Australian species was not eventually found to represent but a form of the one Roxburgh characterized on the basis of Bengal specimens in 1832.

Premna acaulis (F.-Muell.) comb. nov.

Tatea acaulis F.-Muell. Trans. Roy. Soc. S. Austral. **6:** 34. 1883; Junell, Symb. Bot. Upsal. **1**(4)**:** 85. 1934.

This species, the type of the genus *Tatea* F. Muell. (1883), non Seemann (1866), seems to be known only from the two original collections cited in the original description, one between Bridge Creek and McKinlay River at Twelve-Mile, and one from Yam Creek, both in Arnheim's Land, northern Australia. Von Mueller speaks of it as growing in alluvial soil, its underground parts (which he called a rhizome) two feet long. Apparently this "rhizome" was the greatly developed ligneous root which is a characteristic of all of these dwarfed forms of *Premna*.

There is an earlier published *Premna acaulis* Wall. ex Schauer in DC. Prodr. **11:** 637. 1847, but as this appeared only as a synonym, no description ever having been published, it does not invalidate the use of the same specific name within *Premna* for another species. Its use, by Schauer, was apparently due to an error. He listed "P. acaulis Wall. cat. 1776!" but the only entry in Wallich's List under that number, at least in our copy of that work, is *Premna ? pygmaea* Wall., strictly a *nomen nudum;* this was from Nepaul. The entry in *Index Kewensis* was apparently taken from Schauer's work, for both *Premna pygmaea* Wall. and *P. acaulis* Wall. appear in that work, both referring to Wallich "Cat." [List] no. 1776 (1829).

AUSTRALIA: Arnheim's Land, *Tate, Froelsche,* no specimens seen.

Premna herbacea Roxb. Hort. Beng. 46. 1814, *nom. nud.,* Fl. Ind. ed. 2, **3:** 80. 1832, *descr.;* Schauer in DC. Prodr. **11:** 637. 1847; C. B. Clarke in Hook. f. Fl. Brit. Ind. **4:** 581. 1885; Duthie, Fl. Upper Ganget. Plain **2:** 233. 1911; Merr. Enum. Philip. Fl. Pl. **3:** 390. 1923; Dop in Lecomte, Fl. Gén. Indo-Chine **4:** 815. 1935.

Premna pygmaea Wall. List. no. 1776. 1829, *nom. nud.*
Premna acaulis Wall. ex Schauer in DC. Prodr. **11:** 637. 1847, *nom.* in syn.

Gumira herbacea O. Kuntze, Rev. Gen. Pl. **2**: 507. 1891.
Pygmacopremna humilis Merr. Philip. Jour. Sci. Bot. **5**: 225. 1910.
Tatea herbacea Junell, Symb. Bot. Upsal. **1**(4): 85. 1934; Meeuse, Blumea **5**: 637. 1947 (*syn. nov.*).
Tatea humilis Junell, l.c.; Meeuse, l.c. (*syn. nov.*).

INDIA: Punjab, *Koelz 4281* (A, U), pine forest, alt. 600 m.; Assam, *Clarke 42164* (U), alt. 100 m.; Sikkim, *Hooker s.n.* (G), alt. 600 m.; Northwestern Himalayan region, *Thomson, s.n.* (G), alt. 100 m.; Kumaon, *Strachey & Winterbottom 1* (G), alt. 900 m.
BURMA: Kalaw and Maymyo, *Dickason 1175, 5942* (A).
INDO-CHINA: *Pierre 1217* (A), *Thorel 2050* (A), *Poilane 22530* (A), *Petelot 4341* (U).
HAINAN: *McClure 9260* (A), *Lei 1240* (A).
PHILIPPINES: Luzon (Cagayan), *B.S. 7841 Ramos* (U), type collection *Pygmacopremna humilis* Merr.; Mindanao (Bukidnon), *B.S. 26123 Fenix* (A), *28489 Ramos & Edano* (A, U).
LESSER SUNDA ISLANDS: Sumba, *DeVoogt 2253* (A), det. Van Steenis. The specimens examined are preserved in the Arnold Arboretum Herbarium (A), the U. S. National Herbarium (U) and the Gray Herbarium (G).

I am now willing to refer all of the above cited specimens to a single, widely distributed, and considering this wide distribution, slightly variable species. The most comprehensive statement I have seen regarding its distribution in India is that of Duthie who indicated that it extends from the subtropical Himalayan region (Kashmir to Bhutan) to the southern part of the Western Peninsula; Roxburgh's actual type was from Bengal. The Burma, Indo-China, and Hainan specimens before me seem clearly to represent the same species, and this eastern extension is a more or less natural range. Craib recorded it, together with the allied *Premna nana* Coll. & Hemsl., from Siam. In the Philippines it occurs in northern Luzon and in Mindanao. The Sumba specimen is the only collection I have seen from the Malay Archipelago. I expect, however, that future field work in Malaysia may show it to be more widely distributed there. After all the vast areas now covered with coarse grasses are p'aces that normally do not attract either the botanist or the collector. Intensive field work merely proves over and over again that the floras of such areas are strictly limited as to the number of species, and further that nearly all of the species characteristic of these open grasslands are of very wide geographic distribution. On the other hand the primary forest, and for that matter even the secondary forest areas, are infinitely more rewarding from a collector's standpoint. It is suspected that collectors here and there, realizing this situation, may have given only cursory attention to the extensive areas of open grasslands.

Duthie notes that this plant springs up (from its extensively developed ligneous roots) after jungle fires; this is what it does in the Philippines where it is found only in open grasslands which are normally burned over each year in the dry season. Duthie further states: "A good example of a plant belonging to a genus mostly represented by trees and shrubs [some

woody vines], and which has become permanently dwarfed by continuous exposure to periodical fires."

Immediately following a fire, short, practically herbaceous shoots appear which quickly produce leaves and flowers, the internodes then being practically non-existent so that the young leaves appear to be in a whorl of four. Soon, however, the shoot becomes lignified and more or less elongated internodes develop. By the time the fruits are mature the plant has the aspect of a greatly dwarfed, simple, or occasionally slightly branched undershrub, up to about 10 cm. high. One may surmise that its relatively wide distribution in what is a distinctly special habitat, and one that supports a flora limited to peculiarly few distinct species, may be due to the agency of migratory frugivorous birds.

It is suspected that the peculiar habit is a reflection of the habitat where the vegetation is periodically burned. If a dry season passes without the grasslands being burned over, then the original short herbaceous stems become lignified and may persist for a second season, the plants attaining a very modest height (up to 10 cm.), with distinct internodes. I am unable to associate the differences in leaf size and shape, indumentum, and indentation, with other tangible differences in the inflorescences, flowers, and fruits, or with the somewhat elongated internodes of the older more or less ligneous stems as compared with the apparently whorled leaves of the very young shoots. The leaves may be dentate, denticulate, crenate or even undulate-crenate in the upper half or two-thirds, but the basal parts are entire. *Pygmaeopremna humilis* Merr. was originally described as having entire leaves, but the type collection shows that they are minutely and rather distantly denticulate. Many of the specimens have more or less elongated erect woody stems, one or two to five cm. in length; one specimen examined has stems 10 cm. long. In two specimens of *Koelz 4281* from the Punjab, one has almost entire leaves, and the other rather prominently dentate ones. Philippine material has more nearly entire leaves, varying from subentire and minutely denticulate to crenate-undulate or distinctly toothed. Doctor Dop, with more Indo-China material at his disposal than I have, indicates much the same variation in his detailed description.

Premna obovata sp. nov.

Suffrutex parvus, sect. *Pygmaeopremnae,* caulibus vix 3 cm. longis, e radicibus lignosis ut in *Premna herbacea* Roxb. ab qua differt foliis maturis multo majoribus, ad 15 cm. longis et 9 cm. latis, obovatis, integerrimis, apice late rotundatis. Partibus junioribus inflorescentiisque breviter pubescentibus, caulibus pallidis, teretibus, simplicibus vel depauperato ramosis, ad 2 mm. diametro, maturis glabris, internodiis vix 5 mm. longis; foliis (minoribus 3–5 × 1.5–3 cm., integris vel sursum obscure crenato-dentatis, majoribus 15 × 9 cm., integerrimis, apice late rotundatis), chartaceis, sicco pallide olivaceis, subtus pallidioribus, supra consperse sed breviter subhispido-pubescentibus, deorsum angustatis, basi late acutis; nervis primariis utrinque circiter 5, perspicuis, distantibus,

adscendentibus, reticulis laxis; petiolo circiter 5 mm. longo; cymis terminalibus, breviter pedunculatis, circiter 2 cm. longis latisque, breviter subhispido-pubescentibus, bracteis bracteolisque linearis, brevibus; calycibus membranaceis, extus breviter pubescentibus, vix bilabiatis, accrescentibus at sub fructu 4 mm. diametro, subinfundibuliformibus; corolla extus breviter pubescens, intus villosa, vix 2.5 mm. longa, bilabiata, labium superum rotundatum, integrum, inferum subaequaliter 3-lobatum; filamentis brevibus, inclusis; fructibus globosis vel subglobosis, glabris, 5 mm. longis, 2-locellatis.

CHINA: Yunnan Province, Shunning, Hila, *T. T. Yü 16431* (A), on grassy slopes, alt. 1280 m., June 23, 1938 said to be common; the collector noted that the fruits are 2-celled as I find them to be.

This extends the range of this group of dwarfed *Premna* species to Yunnan. In some respects, this proposed new species is suggestive of *Premna herbacea* Roxb., especially in those plants where only the smaller leaves have developed. In the specimens where the leaves have attained their full size, the differences are very striking. Sometimes the young stems are solitary, at other times appearing in fascicles of several, but in the material available none of them are more than about 2 cm. in length and normally each bears one or two pairs of leaves. The most striking character of the species is its very large obovate, broadly rounded, entire, larger leaves; however, in two plants on the sheet the larger leaves have not developed. Only withered corollas were noted.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

ON CERTAIN NOMENCLATURAL ERRORS IN THE EUPHORBIACEAE

E. D. MERRILL

IN 1942 Doctor Croizat [1] definitely demonstrated that the currently used euphorbiaceous generic name *Gelonium* Roxb. (1805), non Gaertn. (1791), was not only invalid, but that it was antedated by the validly published *Suregada* Rottl. Gesellsch. Naturf. Freunde Neue Schrift. 4: 206. 1803. I can only agree with him in this conclusion, for certainly there is nothing to be gained by conserving *Gelonium* Roxb., non Gaertn. against the earlier *Suregada* Rottl. As a matter of fact at the time the genus *Gelonium* was last monographed, eleven of the nineteen species recognized by Pax & Hoffmann [2] had already been placed in *Suregada* by Baillon and others, so it was apparently due to some oversight on their part that they continued to maintain *Gelonium* Roxb. as the proper generic name for the group.

Croizat published twenty-nine transfers, and if all the named and described forms proposed since 1912 prove to be valid, which is definitely not the case, then the total for *Gelonium* Roxb. = *Suregada* Rottl. would now be about forty species. Among these Croizat transfers were the names of seven species originally described by Pax and Hoffmann in 1912, and twenty-two by such authors as Elmer, Gagnepain, Hoyle, Merrill, S. Moore, Prain, and Ridley published since the Pax and Hoffmann monograph was issued. In other words, even if not quite all of the species proposed since 1912 prove to be distinct and valid, the genus has been more than doubled in size in less than forty years.

At the end of his discussion Croizat stated that he intended to prepare a critical revision of the group at a later date, but there is no evidence that any further work was done on the rather ample collections at the Arnold Arboretum after his hurriedly prepared paper of 1942 was finished; the manuscript must have been completed and forwarded sometime before the end of 1941, but no copies of the printed document became available until 1948. Perhaps this explains why Croizat did no more work on the group. It is evident that without even casually examining the specimens which were available to him, and without scanning the original descriptions of all the species proposed after 1912, Croizat accepted each name on its face value and made the transfers without discussing the individual cases. In three cases the descriptions appertain to non-euphorbiaceous species, and not only had two of these three fugitive *Gelonium* species been

[1] CROIZAT, L. Notes on the Euphorbiaceae. Bull. Jard. Bot. Buitenz. III. 17: 209–219. 1942 (p. 212, The Reinstatement of Suregada).

[2] PAX, F. & HOFFMANN, K. Euphorbiaceae-Gelonieae. Pflanzenreich 52(IV. 147. IV): 1–41. 1912.

placed in the genera where they manifestly belong, in actual publication as of 1923, but the actual type numbers of all three were before him when he prepared his manuscript. This is perhaps a good illustration of how original errors are perpetuated when a "new species" is proposed and characterized but placed not only in the wrong genus, but in the wrong family.

Two of Croizat's *Suregada* names belong in the violaceous genus *Rinorea,* and the third one in the flacourtiaceous genus *Casearia.* One has only to scan the descriptions of the floral details to realize at once that, if the data published by Elmer were only in part correct, no *Gelonium* could possibly be represented by any of the three descriptions, and at least in one case no representative of a euphorbiaceous genus. Moreover, perhaps as an indication of the speed with which his nomenclatural paper was written, Croizat curiously overlooked the fact that in 1914, Pax and Hoffmann, op. cit. 63(IV. 147. VII): 414, on the basis of an examination of the type collections, had disposed of five of Croizat's *Suregada* species.

Gelonium meliocarpum Elm. = *Suregada meliocarpa* Croizat = *Gelonium glomerulatum* Hassk. = *Suregada glomerulata* (Blume) Baill.; *Gelonium subglomerulatum* Elm. = *Suregada subglomerulata* Croizat = *Gelonium glomerulatum* Hassk. = *Suregada glomerulata* (Blume) Baill.; and *Gelonium pulgarense* Elm. = *Suregada pulgarense* Croizat = *?Gelonium glomerulatum* Hassk. = *Suregada glomerulata* (Blume) Baill. These reductions I accepted in 1923 (Enum. Philip. Fl. Pl. 2: 456), but I still have an open mind as to whether or not all of the Pax and Hoffmann reductions are correct. At the same time, I had, perhaps erroneously, reduced *Gelonium mindanaense* Elm. = *Suregada mindanaensis* Croizat, to *Gelonium philippinense* Pax & Hoffm. = *Suregada philippinensis* Croizat, although Pax and Hoffmann in 1919 recognized it as distinct. Furthermore they expressed doubt if *Gelonium tenuifolium* Ridl. = *Suregada tenuifolia* Croizat belongs in the genus because of the indicated aberrent style characters, and op. cit. 68(IV. 174. XIV): 52. 1919, suggest that *Gelonium procerum* Prain = *Suregada procera* Croizat is but a variety of *Gelonium lithoxylon* Pax & Hoffm. = *Suregada lithoxyla* Croizat.

As to the three non-euphorbiaceous species that Elmer erroneously placed in *Gelonium,* and which Croizat erroneously perpetuated in *Suregada,* Pax and Hoffmann, Pflanzenreich 63(IV. 147. VII): 414. 1914, correctly excluded two of them from the genus but made no suggestions as to what groups might be represented. For *Gelonium glandulosum* Elm. = *Suregada glandulosa* Croizat = **Rinorea glandulosa** (Elm.) Merr. (type *Elmer 12315,* Sibuyan Island) they said: "Certissime non ad genus pertinet," and for *Gelonium trifidum* Elm. (type *Elmer 12143,* Sibuyan Island) = *Suregada trifida* Croizat = **Rinorea fasciculata** (Turcz.) Merr. they also said, correctly: "Non ad *Gelonium* pertinens et cum antecedente congenericum." I disposed of these two species, Enum. Philip. Fl. Pl. 3: 104. 1923, one as the basis of *Rinorea glandulosa* (Elm.) Merr., the other as a synonym of *Rinorea fasciculata* (Turcz.) Merr. (*Pentaloba*

fasciculata Turcz., *Alsodeia fasciculata* F.-Vill.), of the Violaceae. While I have a mental reservation to the effect that a critical revision of *Rinorea* may lead to some change of status here, yet in both cases the natural group indicated is definitely the correct one.

The last case is perhaps even more strange than those just discussed. *Gelonium pinatubense* Elm. Leafl. Philip. Bot. 9: 3186. 1934, based on *Elmer 22032, 21966*, from the eastern or Pampangan slopes of Mount Pinatubo, Luzon = *Suregada pinatubaensis* Croizat = **Casearia trivalvis** (Blanco) Merr., 1918 (*Samyda trivalvis* Blanco, 1837; *Casearia solida* Merr., 1905; *Casearia zschokkei* Elm., 1919). Here Croizat had borrowed the Gray Herbarium sheets for his preliminary work. A mere glance at these shows that no *Gelonium* could possibly be represented. I now have had the opportunity of examining another set of the two *Elmer* numbers. While no mature flowers are available (very young buds only), and somewhat immature fruits, the genus represented is definitely *Casearia* of the Flacourtiaceae, and this in spite of Elmer's confused description of certain floral parts. He apparently misinterpreted the staminodes, for his description of the filaments reads: "subtended by ciliate linear bracts and alternating with the subclavate ciliate appendages," characters utterly foreign to *Gelonium* no matter how stated, but sufficiently understandable in *Casearia* even if no duplicate types were available. Incidentally it seems to be evident that Elmer's indicated measurement of the perianth segments (sepals) as being up to 1 cm. in length, is also erroneous.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

A TAXONOMIC REVISION OF PODOCARPUS
V. THE SOUTH PACIFIC SPECIES OF PODOCARPUS: SECTION STACHYCARPUS

NETTA E. GRAY AND JOHN T. BUCHHOLZ

With four plates

THE SPECIES of *Podocarpus* concerned in this treatise all belong to section *Stachycarpus*. An earlier installment (5) was devoted to the five South American species and several varieties of this section. The South Pacific species discussed in this paper complete the group now included in this section. These fall into two subsections, A. *Euprumnopitys* and B. *Idioblastus*. Subsection *Euprumnopitys* includes the two New Zealand species (*P. spicatus* and *P. ferrugineus*) as well as all American species in the previous installment. The name, *Prumnopitys,* for this group was used in a category equivalent to a section by Bertrand (3), but, as such, must be considered a synonym under the earlier section, *Stachycarpus* Endlicher. The name had been proposed originally as a generic name in the binomial *Prumnopitys elegans* Phillipi where it is clearly a synonym under *Podocarpus andinus* Poeppig. Nevertheless Philippi's binomial was continued until very recently in the horticultural trade. Dallimore and Jackson continued to use this binomial and only changed it to *Podocarpus andinus* in the 3rd edition (1948). In using this name, *Prumnopitys*, as a subsection under *Stachycarpus*, we are adding a prefix: *Euprumnopitys*. Subsection *Idioblastus* includes species in New Caledonia and the Queensland area of Australia, which differ in the presence of idioblastic sclereids (Plates III; IV, figs. 3–10) within the leaves, this being especially distinctive as it is the only group in *Podocarpus* with this type of sclereid. In the general description of this section (4) the section *Stachycarpus* is distinguished by small flat leaves (usually less than 3 cm. long by 0.5 cm. wide), with a single median vein and resin canal below, without hypoderm, without vascular fibers or sclereids and accessory transfusion tissue, the stomata showing the Florin ring present and the subsidiary cells usually amphicyclic (6). The exception to the usually hypostomatic leaves occurs in *P. ferruginoides*, *P. distichus* and its variety, in *P. Ladei*, and more rarely in juvenile foliage of *P. ferrugineus* where there are stomata in the upper epidermis especially over the midrib.

Transfusion tissue, usually of the type with reticulated-scalariform thickenings, is always present in the leaves of Podocarpaceae. It may be considered as a part of the vascular bundle with which it is intimately associated.

Accessory transfusion tissue, present in most Podocarpaceae, is entirely absent in subsection *Euprumnopitys* or, in subsection *Idioblastus*, it may

be represented by more or less isolated idioblastic sclereids that do not form a continuous tissue system. These elements should be related to the mesophyll of the leaf, as is the case for accessory transfusion tissue, the isolated sclereids of section *Afrocarpus*, and the auxiliary sclereids found in a number of species of subsection D of section *Eupodocarpus*. The idioblasts, very irregularly shaped sclereids with thick pitted walls, large lumina and without cell contents, may not be articulated with the transfusion tissue, at least not at the time when they begin to differentiate in the mesophyll. The abundance and pattern of these cells in the blade of the leaf deserve special consideration which will be given under the species involved.

Orr (18) was the first to describe these sclereids in the leaves of section *Stachycarpus* of *Podocarpus* where he observed them in *P. Ladei* and *P. ferruginoides*. His fig. 3, plate 2, shows these idioblasts in the latter species.

Early investigations utilizing idioblastic sclereids as taxonomic characters include a treatise by Pestalozzi (19) on *Boscia*. In recent work, Bailey and Nast (1, 2) and Foster (8, 10, 11) have considered sclereids as diagnostic characters in certain angiosperms, while Foster (8, 9, 12) has studied the ontogeny of sclereids in angiosperm leaves and Sterling (20) their origin in the shoot apex of *Pseudotsuga*. The various publications of Foster and his recent book (13) have given the historical background.

SUBDIVISIONS OF SECT. STACHYCARPUS

SUBSECTION A. **Euprumnopitys** (*Prumnopitys* Bertrand) Buchholz & Gray, nov. subsect.

Foliis sine sclereidibus in mesophyllo, hypostomaticis in foliis maturarum, sed in foliis juniorum plantarum *Podocarpi ferruginei* interdum extant quaedam in facie superiore stomata.

(Includes *P. spicatus* and *P. ferrugineus* as well as all American spp.)

SUBSECTION B. **Idioblastus** Buchholz & Gray, nov. subsect.

Foliis cum sclereidibus in mesophyllo, amphistomaticis, stomatibus in facie superiore multo-rarioribus quam in inferiore.

(Includes *P. ferruginoides, P. Ladei* and *P. distichus*.)

KEY TO THE SOUTH PACIFIC SPECIES OF PODOCARPUS BELONGING TO THE SECTION STACHYCARPUS

Idioblasts (or other sclereids) absent in the mesophyll of the leaves that are without hypoderm *.....Subsection A. *Euprumnopitys*.

Stomata always confined to the lower surface of the leaf; margin of the leaf symmetrically rounded and not tending to be revolute; male strobili spicate and numerous on special branches; female branchlets 4 cm. long; seed 8–9 mm. long, blackish.....*P. spicatus*.

* The two South Pacific species belonging here stand nearest to *P. andinus* of the American species. In our former key they belong with the category of leaf types essentially flat above. All American species of *Stachycarpus* are without sclereids.

Stomata very rarely found over midrib of the upper surface; leaf margins asymmetrically pointed and sometimes almost revolute; male strobili borne singly in axillary position or replacing foliage leaves; female branchlets 1 cm. long; seed 15–17 mm. long, red..... .....*P. ferrugineus.*

Idioblasts present in the mesophyll of the leaves that are without hypoderm and are unequally amphistomatic.....Subsection B. *Idioblastus.*

Leaves with some stomata scattered over the entire upper surface; idioblasts small, mostly less than 250–300μ long and well separated (plate IV, figs. 3 & 4); seed large, 2.5 cm. long.....*P. Ladei.*

Leaves with stomata of the upper surface relatively few, confined to the region of the midrib from the middle toward the apex.

Idioblasts mostly 300μ or more (up to 550μ) long and closely crowded together (plate IV, figs. 5 & 6); lower epidermal cells with simple walls, often slightly wavy but not dentate (plate IV, fig. 1); leaves 9–19 mm. long, 1.5–4 mm. wide...*P. ferruginoides.*

Idioblasts becoming more than 550μ long; epidermal cells with distinctly wavy or dentate walls (plate IV, fig. 2).

Leaves with revolute margins, 10–15 mm. long, 2–3.5 mm. wide; idioblasts separated, becoming 600–750μ long (plate IV. figs. 7 & 8); trees; seeds 12–15 mm. long, crested..... .....*P. distichus.*

Leaves with narrowed or tapered, obtusely rounded margins, 2–3 cm. long, 5–6 mm. wide, nearly flat; idioblasts becoming 850–1100μ long, closely crowded; known only as shrubs.... .....*P. distichus* var. *maialis.*

Podocarpus spicatus R. Br. in Bennett, Pl. Jav. Rar. 40. 1838; Hooker, Icon. 6: *t. 543.* 1843; Endlicher, Syn. Conif. 221. 1847; Hooker f., Fl. Nov. Zeland. 232. 1853; Handb. N. Z. Fl. 258. 1864; Carrière, Traité Conif. 675. 1867; Parlatore in DC. Prodr. 16(2): 519. 1868; Pilger in Pflanzenreich IV. 5(Heft 18): 65. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Mahlert in Bot. Centralbl. 24: 280, 281. 1885; Kirk, For. Flora N. Z. 5. 1889; Cheeseman, Man. N. Z. Fl. 650. 1906, ed. 2, 113. 1925; Allan in Trans. & Proc. N. Z. Inst. 56: 39–42. 1926; Cockayne, Veg. N. Z. 1921, 1928; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262, 263, 266. 1931; Dallimore & Jackson, Handb. Conif. 55. ed. 2, 1931, ed. 3, 81. 1948; Laing & Blackwell, Pl. N. Z. 66. 1940.

Dacrydium taxifolium Banks & Sol. ex Don in Lamb. Pin. ed. 1, 2: 25. 1824, ed. 2, 2: 119. 1828.

Dacrydium ?(*Mai*) A. Cunn. in Ann. Nat. Hist. 1: 213. 1838.

Dacrydium Mayi van Houtte ex Gordon, Pinetum 287. 1858.

Prumnopitys spicata Kent in Veitch, Man. Conif. ed. 2, 157. 1900.

Stachycarpus spicata Van Tieghem in Bull. Soc. Bot. France 38: 173. 1891.

This tree has long been known from New Zealand where it was one of the more important timber trees, having a thick trunk and becoming 25 m. tall. Useful descriptions and figures of the species are to be found in Kirk (16) and Laing & Blackwell (17). Vegetative buds small with

obtuse scales. Leaves linear, coriaceous, sessile, 1.0–1.5 cm. long and 1.0–1.5 mm. wide, midrib scarcely raised. In leaf cross section, this species can best be distinguished from *P. ferrugineus* by the very rounded margins. The very narrow leaves have the least number of rows of stomata, each band varying from 7 to 14 rows which are closely packed. In the upper epidermis we have not found any stomata. A study of the development of young leaves was made by Griffin (15) who found very slight lignification of the walls of mesophyll cells which showed a transverse orientation in the blade of the leaf.

When mature fruit of the tree is available the black color distinguishes it from *P. ferrugineus*. Peduncle about 4 cm. long. Also, the abundant (20–30) male strobili on a single peduncle are in contrast to the scattered, more solitary, axillary cones borne on leafy twigs of *P. ferrugineus*.

DISTRIBUTION: In New Zealand, on both North and South Island, but rarely on Stewart Island.

SPECIMENS EXAMINED:

NEW ZEALAND: NORTH ISLAND: Auckland Dist.: (voyage Astrolabe, ex Mus. Paris) *Hombron* in 1841 (GH*); Oruanui, near Wairakei, *Setchell* in 1904 (UC); Kahikanui, *Setchell* in 1904 (UC); Wangarusi, *Allison s.n.* (A); near Taumaranui, *Cockayne 9097* (A), *Cockayne 6659* (UC); Wellington Dist.: Wairarapa, *Kirk s.n.* (†Mo). SOUTH ISLAND: Nelson Dist.: near Murchison, *Cockayne 8556* (A); Marlborough Dist.: Pelorus Sound, *Kirk s.n.* (A, †F, †GH); Canterbury Dist.: Banks Peninsula (Presqu' île de Banks) *Raoul* in 1843 (ex Mus. Paris) (GH); *J. Haast* in 1866 (†BR—2 sheets); *Kirk* 295, *Colenso* (GH); Invercargill?, *G. C. Smith s.n.* (A). LOCALITY UNKNOWN: Matai valley, *Cheeseman s.n.* (Ph); Limestone Creek Forest, Hunderlee, *Cockayne 6661b* (A); *Védel* in 1847 (voyage M. Bérard) (†BR, GH, Ph), *Védel s.n.* (NY); Anon. (ex J. M. Coulter) (†F); *Cunningham* in 1826 (†BR); *R. Brown 27, 60, 120, 3116* (TYPE on 2 sheets, British Museum). CULTIVATED: England: Roy. Bot. Gard. Kew, *Cook* in 1937 (†Ill); California: Golden Gate Park, *Eastwood* in 1916 (CAS); *Engelmann* in 1868, ex Hort. Neapol. (†Mo).

Podocarpus ferrugineus Don ex A. Cunn. in Ann. Nat. Hist. **1**: 212. 1838; Hooker, Icon. **6**: *t. 542*. 1843; Endlicher, Syn. Conif. 220. 1847; Hooker f., Fl. Nov. Zeland **1**: 232. 1853; Carrière, Traité Conif. 674. 1867; Parlatore in DC. Prodr. **16**(2): 519. 1868; Bertrand in Ann. Sci. Nat. ser. 5, **20**: 61. 1874; Mahlert in Bot. Centralbl. **24**: 280, 281. 1885; Kirk, Forest Fl. N. Z. 163. 1889;

* The following symbols indicate the herbaria having the specimens cited: Academy of Natural Sciences at Philadelphia (Ph), Arnold Arboretum (A), Brussels, Belgium (BR), University of California at Berkeley (UC), California Academy of Sciences (CAS), Chicago Natural History Museum (Field Museum) (F), University of Illinois (Ill), Gray Herbarium (GH), Missouri Botanical Garden (Mo), New York Botanical Garden (NY), United States National Herbarium (US).

† This symbol preceding the abbreviated name of an herbarium following the specimens examined signifies that the details of the leaves of this specimen have been examined in cross-section.

Kent in Veitch Man. Conif. ed. 2, 150. 1900; Pilger in Pflanzenreich IV. 5(Heft 18): 66. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Cheeseman, Man. N. Z. Fl. 650. 1906, ed. 2, 113. 1925; Cockayne, Veg. N. Z. 1921, 1928; Dallimore & Jackson, Handb. Conif. ed. 2, 45. 1931, ed. 3, 68. 1948; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262. 1931; Laing & Blackwell, Pl. N. Z. 66, 1940.

Stachycarpus ferruginea Van Tieghem in Bull. Soc. Bot. France 38: 173. 1891.

Trees of this species are also very large important timber trees of New Zealand. Descriptions and figures of the tree may be found in Kirk (16) and Laing & Blackwell (17). The juvenile foliage is longer than the adult foliage and the leaves are a little wider than in *P. spicatus*. In cross section the leaf margins show a point or angle toward the lower surface, which can hardly be described as a tendency to be revolute, but nevertheless is in contrast to the rounded edge of the leaves of *P. spicatus*. The transfusion tissue consists of only about a half-dozen cells as seen in cross section.

Four specimens among those we examined (collected by Morhange, Capt. Home and two by Kirk) show a few stomata in the upper epidermis above the midvein. This would agree with Griffin (15) who found stomata in the upper epidermis of leaves of young specimens. She found that the mesophyll was somewhat transversely elongated but no evidence of lignification. The stomata are not in compact bands, appear more or less scattered and are rarely or only slightly separated by a midvein area without stomata.

DISTRIBUTION: New Zealand, according to Kirk (16) more plentiful on South Island than North Island and constituting a large part of the Stewart Island forests. It ranges from sea level to 3000 ft. altitude.

SPECIMENS EXAMINED:

NEW ZEALAND: NORTH ISLAND: Auckland Dist.: Whangarie Falls, *Setchell* in 1904 (†UC); Rautangata, *Setchell* in 1904 (UC); Kaipara Harbour, *Kirk 242* (GH); *Kirk s.n.* (NY); Bay of Islands, U. S. Exploring Exped. under Capt. Wilkes 1838–42 (GH). Wellington Dist.: Mt. Ruapehu, *Meebold 17905* (NY); Wellington, *Lawton s.n.* (†Ill). SOUTH ISLAND: Canterbury Dist.: *J. Haast 233* (†BR); Longwood Forest, *Cockayne 6658* (GH), *Cockayne 6660* (†F, 2 sheets), *Cockayne 9096* (A, 2 sheets); *Kirk s.n.* (†F); *Kirk s.n.* (†Mo). Stewart Island: *Kirk s.n.* (A). LOCALITY UNKNOWN: Murbel Beach, *Wilson* in 1921 (A, 3 sheets); *A. Cunn. s.n.* (A. R. Steward, 1850?) (NY); *Morhange s.n.* (†BR, 2 sheets); *J. D. Hooker 46* (†BR); *Home s.n.* (Brit. Mus.). CULTIVATED: New Zealand: Aukland, *Wilson* in 1921 (A). California: Golden Gate Park, *Eastwood* in 1916 (CAS), *Walther* in 1922 (CAS), *Walther* in 1924 (A).

Podocarpus Ladei Bailey in Queensland Agricultural Jour. 15: 899. 1905; Bailey, Cat. Queensland Pl. 512, 1910; Pilger in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Florin in Svenska Vet.-Akad. Handl. ser.

3, 10(1): 262, 264, 266. 1931; Dallimore & Jackson, Handb. Conif. ed. 1, 48. 1923, ed. 2, 1931, ed. 3, 72. 1948.

A tall erect tree with a stem attaining a diameter of 1.7 m. with thin, smooth reddish brown bark which is shed in thin scales. Leaves sessile, spirally attached but spreading apart in one plane, green on both surfaces, oblong, 12–16 mm. long, 2.5–4 mm. wide, obtuse, the midvein usually evident, but not prominent, with stomata on both surfaces, but about twice as numerous below as above. Pollen cones unknown. Female branchlets with large sessile obovoid seeds near the ends, becoming about 25 mm. long, 15 mm. wide, pointed at both ends.

DISTRIBUTION: In Australia, Queensland, the region of Mt. Spurgeon and Atherton near Port Douglas.

SPECIMEN EXAMINED:

AUSTRALIA: QUEENSLAND: Atherton, *Morrotsy* in 1923 (†A).

This extremely rare species exists, to our knowledge, in the herbaria in only two collections — the one listed above and the type, collected by *Lade* in 1905 on Mt. Spurgeon, Mitchell River, Port Douglas. It is larger than any other tree in this group, the trunk attaining a diameter of about 1.7 meters. The leaves are distichous, usually obtuse, and almost sessile. In transverse section the leaves show similar anatomy to *P. ferruginoides*. The margins, however, tend to taper symmetrically toward the edge rather than either being bluntly rounded or pointed toward the lower side, and there is more extensive area of transfusion tissue. The stomata on the lower surface are quite abundant in the broad leaves, interrupted by the midvein into two bands of 20–26 loosely arranged rows. They are abundant enough in the upper epidermis to call the leaf truly amphistomatic. On the upper surface they are scattered and not interrupted by the midvein. The abundance of stomata, 33 rows across the top of the leaf, is about that on the lower surface of *P. ferrugineus*. They tend often to be monocyclic instead of amphicyclic as they are in the lower epidermis. Epidermal cells between stomata have peculiar vertical walls that might be described as combining a dentate with an undulating pattern. The sclereids are the smallest found in subsect. *Idioblastus*, usually less than 250–300μ long, often less than half this length and are branched or multilobed, as shown in plate IV, figs. 3 & 4.

Podocarpus ferruginoides Compton in Jour. Linn. Soc. Bot. 14: 424. 1922; Pilger in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262, 264–266. 1931; Dallimore & Jackson, Handb. Conif. ed. 2, 45. 1931; ed. 3, 68. 1948.

A tree becoming 10–15 m. high with an erect trunk and a rough dark gray or blackish bark thin and scaling off in flakes. Branching irregular and ending in numerous twigs clothed with coriaceous dark green leaves, spirally attached, patent but spread apart distichously and persisting for several years. Leaves oblong-oblanceolate, minutely cuspidate, 10–18 mm. long, 2.5–3 mm. wide, almost sessile but really on very short twisted

petioles 0.5 mm. long. Pollen cones unknown. Female reproductive branchlets axillary, 5–8 mm. long, thickly covered at base with minute triangular scales, the scales becoming larger and linear toward the distal end; scales 3–5 mm. long but scarcely 1 mm. wide, obtuse, more or less recurved, glaucous, resembling small leaves, of which the terminal bears one (seldom 2, only 1 developing) axillary ovule. Ovules ovoid, glaucous, obtusely apiculate. Seed ovoid, without crest, 12–14 mm. long, glaucous, the testa of two layers, the outer fleshy and the inner indurated. Plate I shows a photograph of a part of the type specimen.

DISTRIBUTION: In New Caledonia, on Mt. Humboldt, at the summit, and on Mt. Nekando, its eastern spur.

SPECIMENS EXAMINED:

NEW CALEDONIA: Mt. Nekando, *Compton 1068* (†Cambridge); *Compton 1073* (Brit. Museum); Mt. Humboldt, *Buchholz 1572, 1573* (Plate II, fig. 1; Plate III, fig. 1) (†Ill, with duplicates distributed elsewhere).

This is one of the less known species, having been first described in 1922 by Compton (6) from specimens he collected himself. When Orr (18) originally described the idioblasts to be found in this group, he used *Compton 1073*, the type specimen. His figure is of a leaf transverse section from this specimen.

In 1948 new collections added much to our knowledge of this species. On Mt. Humboldt it is a tree 8–9 m. high and 36 cm. in diameter at 1500 m. altitude on the west slope (*Buchholz 1573*), but at the summit, 1640 m., it is a low shrubby tree only 1–1.5 m. high (*Buchholz 1572*).

Small plants have leaves essentially similar to the adult form. Both the tree and shrub from Mt. Humboldt have idioblasts that agree very closely with those in the leaves of *Compton 1073* (examined from type specimen of British Museum) as well as *Compton 1068* (dried from alcoholic specimen of Compton's botanical collections at Cambridge). The specimens agree closely with a leaf from the type specimen as well as with the photomicrograph in Orr (18); hence there is no doubt concerning the identity of *Buchholz 1572* and *1573* from Mt. Humboldt. The sclereids are distinctly larger than in the preceding species. They are usually more than 300, up to 550μ long, which is less than the larger sclereids in the species and variety that follow. Their branching is irregular, with relatively short branches or knobs and they are very closely crowded as shown in Plate IV, figs. 5 & 6.

In the lower epidermis of the leaf, the stomata are not arranged in two bands separated by the midrib, but are usually scattered across the surface and are more abundant than in *P. ferrugineus*. The stomata to be found in the upper epidermis vary from 1–11 rows, where they are always located over the midrib and not in the marginal parts of the blade. The simple walls of epidermal cells in the lower surface of the leaf are shown in Plate IV, fig. 1. Florin (7) has studied the epidermis of this species and interpreted the stomatal structure as amphicyclic.

Podocarpus distichus Buchholz sp. nov.

Arbor demum 4–5 m. alta ramis 6 cm. vel ultra diametro, cortice atrogriseo subruvido. Ramis iterum ramulosis angulo acuto orientibus ob folia decurrentia longitudinaliter per internodia sulcatis. Alabastris terminalibus perulis longius attenuatis patentibus insignatis. Foliis spiraliter impositis sed distiche pectinatinque ob petiolum curvum patentibus, per annos 3–4 persistentibus. Foliis ex oblongo-lanceolatis ad oblongo-oblanceolatis, junioribus acutis minuteque cuspidatis, ad basem obliquis angustatisque, petiolo curvato decurrente, 1–1.5 cm. longis, 2–3.5 mm. latis, 0.5 mm. crassis, costa interdum facie supera subelevata, subtus canaliculo brunneo notata. Foliis hypodermate destitutis, ducto resinifero ad phloematem unico, sclereidibus ramosis per mesophyllum more proprio dissitis ad 500–750μ longis. Stomatibus saepius in facie foliis infera impositis, in supera paucioribus tantum ad costam. Cellulis epidermaticis inter stomata parietibus undulosis notabilibus.*

HABITAT: Mountains bordering the valley of the Kouaoua River on the eastern slopes of central New Caledonia and Table Unio, Mt. Mou.

SPECIMENS EXAMINED: Table Unio, Kouaoua, *Lecard* in 1878 (TYPE, Herb. Museum National d'Histoire Naturelle, Paris, fragment and photograph †Ill), *Buchholz 1600* (†Ill) (Plate II, fig. 2; Plate III, fig. 2), Mt. Mou, *Buchholz 1788* (†Ill); parts of both in Herb. Paris, and elsewhere.

This tree appears to be rare on Mt. Mou. It has escaped the notice of previous collectors and was found accidentally when a branch was broken from it by Mr. Luc Chevalier in collecting male specimens of *Acmopyle Pancheri* in a dense tangle of other trees and shrubs.

This species has abundant sclereids in the mesophyll of the leaf. These are idioblasts of elongated form, each with slender cylindrical body and numerous slender dendritic branches. They occur in various assorted sizes up to 750μ in length and are 50% larger than the sclereids in *P. ferruginoides*.

It seems likely that the idioblastic sclereids of this section of *Podocarpus* are distinctive in having diagnostic value as reliable as any single taxonomic character. The species before us could probably be identified by the idioblasts alone. When taken in combination with other characters, such as the epidermal cell walls as well as external taxonomic features there can be little doubt left concerning the identity of the species.

Podocarpus distichus var. **maialis** Buchholz nov. var.

Frutex vel arbor, cortice obscuro subnigro asperato. Foliis saturate viridibus, elliptice oblongis, apice obtusis basis obliquis, subtus angustatis, petiolo torto minus quam 2 mm. longo, 2–3 cm. longis, 5–6 mm. latis, costa unica supra elevata, subtus subplanis vel canaliculatis, ramo spiraliter

* Data received since this paper went to press furnish the following addition to the description: Seeds single, 13–15 mm. long, crested and slightly flattened, with related bract ovate-lanceolate adherent to seed. Cone peduncles 7–9 mm. long, borne axillary and clothed with numerous small scales, the uppermost 3 or 4 of which become 2–3 mm. long and slightly spreading but not recurved.

impositis at habitu pectinatis, petiolo in ramum decurrente. Stomatibus in folii facie infera confertis, in facie supera seriebus 3–10 dissitis ad costam dispositis. Foliis intus idioblastis more proprio efformatis praeditis ad 850–1100μ longis.

HABITAT: Forêt du Mois de Mai, bordering Plaine des Lacs, in southern New Caledonia at about 400 m.

SPECIMENS EXAMINED: *Buchholz 1391,* TYPE in †Herbarium University of Illinois (Plate II, fig. 3) and part in Herb. Mus. National d'Histoire Naturelle, Paris; *Bernier 360, Bernier 294* (Paris Museum, fragments only seen).

This may be a juvenile specimen, the seedling of an unrecognized larger tree. It is nevertheless possible to name and describe this entity as a definite variety if not a distinct species, belonging to subsection *Idioblastus* and most closely related to *P. distichus.* The distinctions from *P. distichus* are the much larger leaves, and fewer bud scales as indicated by the scale scars of annual growth shoots. In cross sections of the leaves the margins are more tapered than pointed toward the lower surface and the transfusion tissue is much more apparent than in *P. ferruginoides.* The idioblasts are much more abundant and considerably larger in this variety than in the species. From these criteria it should be possible to identify any later collections, adding descriptions of the reproductive parts where possible. The lower epidermis is shown in Plate IV, fig. 2.

LITERATURE CITED

1. BAILEY, I. W. and CHARLOTTE G. NAST. The comparative morphology of the Winteraceae. V. Foliar epidermis and sclerenchyma. Jour. Arnold Arb. **25:** 97–103. 1944.
2. ——— and ———. Morphology and relationships of *Illicium, Schisandra* and *Kadsura.* I. Stem and Leaf. Jour. Arnold Arb. **29:** 77–89. 1948.
3. BERTRAND, C. E. Anatomie comparée des tiges des feuilles chez les Gnétacées et les Conifères. Ann. Sci. Nat. Paris sér. 5, **20:** 5–153. 1874.
4. BUCHHOLZ, JOHN T. and NETTA E. GRAY. A taxonomic revision of *Podocarpus.* I. The sections of the genus and their subdivisions with special reference to leaf anatomy. Jour. Arnold Arb. **29:** 49–63. 1948.
5. ——— and ———. A taxonomic revision of *Podocarpus.* II. The American species of *Podocarpus:* Section Stachycarpus. Jour. Arnold Arb. **29:** 64–76. 1948.
6. COMPTON, R. H. A systematic account of the plants collected in New Caledonia and the Isle of Pines. Part II. Gymnosperms. Jour. Linn. Soc. Bot. **45:** 421–434. 1922.
7. FLORIN, R. Untersuchen zur Stammesgeschichte der Coniferales u. Cordaitales. Erster teil. Morphologie und Epidermisstruktur der Assimilationsorgane bei den rezenten Koniferen. Svenska Vet.-Akad. Handl. ser. 3, **10:** Stockholm. 1931.

8. Foster, A. S. Structure and development of sclereids in the petiole of *Camellia japonica* L. Bull. Torrey Bot. Club. **71:** 302–326. 1944.
9. ———. Origin and development of sclereids in the foliage leaf of *Trochodendron aralioides* Sieb. & Zucc. Am. Jour. Bot. **32:** 456–468. 1945.
10. ———. The foliar sclereid of *Trochodendron aralioides* Sieb. & Zucc. Jour. Arnold Arb. **26:** 152–162. 1945.
11. ———. Comparative morphology of the foliar sclereids in the genus *Mouriria* Aubl. Jour. Arnold Arb. **27:** 253–271. 1946.
12. ———. Structure and ontogeny of the terminal sclereids in the leaf of *Mouriria Huberi* Cogn. Am. Jour. Bot. **34:** 501–514. 1947.
13. ———. Practical Plant Anatomy. Revised Edition. 1949.
14. Foweraker, C. E. The distribution of the Podocarpaceae. New Zealand Jour. For. **3:** 160–165. 1934.
15. Griffin, E. M. The development of some New Zealand conifer leaves with regard to transfusion tissue and to adaptation to environment. Trans. N. Z. Inst. **40:** 43–72. 1907.
16. Kirk, T. The Forest Flora of New Zealand. 1889.
17. Laing, R. M. and E. W. Blackwell. Plants of New Zealand. 4th edition. Aukland, London. 1940.
18. Orr, M. Y. The leaf anatomy of *Podocarpus*. Trans. Bot. Soc. Edinburgh **34**(1): 1–54. 1944.
19. Pestalozzi, A. Die Gattung *Boscia* Lam. Bull. de l'Herbier Boissier 6, Appendix III: 1–152. 1898.
20. Sterling, C. Sclereid formation in the shoot of *Pseudotsuga taxifolia*. Am. Jour. Bot. **34:** 45–52. 1947.

EXPLANATION OF PLATES

PLATE I

Podocarpus ferruginoides Compton. Photograph natural size of part of type specimen showing reproductive parts. Several fertile branches bearing ovules near time of pollination are shown at right and similar branches with seeds, presumably a year older, at left. Mt. Nekando, the type locality, is an eastern spur of Mt. Humboldt.

PLATE II

Fig. 1. *Podocarpus ferruginoides* Compton, *Buchholz 1573* from tree near summit of Mt. Humboldt. × 1. Fig. 2. *Podocarpus distichus*, part of *Buchholz 1600* from a tree on mountain slopes of Kouaoua valley. × 1. Fig. 3. *Podocarpus distichus* var. *maialis*, *Buchholz 1391* from Forêt du Mois de Mai, Plaine des Lacs. × 1.

PLATE III

Fig. 1. *Podocarpus ferruginoides* Compton, from *Buchholz 1573*, transverse section of leaf showing very thick cuticle with epidermal cells smaller than cuticular thickness above; absence of hypoderm; abundant sclereids within the leaf. Stomata shown below midvein as well as in blade, a few

stomata occurring also on the upper side in region above midvein. × 105. FIG. 2. *Podocarpus distichus*, from *Buchholz 1600*, whole mount of entire leaf cleared with NaOH, the midvein and sclereids stained, mounted in balsam. The stomata may be seen as faint dots in the clear areas. × 16.

PLATE IV

FIG. 1. *Podocarpus ferruginoides* Compton, *Buchholz 1573*, showing walls of epidermal cells between stomata not undulate — straight or occasionally denticulate. × 425. FIG. 2. *Podocarpus distichus* var. *maialis*, from leaf of *Buchholz 1391* showing undulate walls in epidermal cells between stomata. (*P. distichus* has a similar lower epidermis.) × 425. FIG. 3. *Podocarpus Ladei* Bailey, from leaf of *Morrotsy* in 1923, showing dispersed sclereids and midvein; stomata may be seen in cleared areas. × 21. FIG. 4. Sclereids of same removed and isolated by dissection. × 61. FIG. 5. *Podocarpus ferruginoides* Compton, from leaf of *Buchholz 1573* showing midvein with very abundant closely crowded sclereids. ×21. FIG. 6. Sclereids removed by dissection from similar leaf of *Compton 1073*. × 61. FIG. 7. *Podocarpus distichus*, part of the cleared leaf shown in Plate III, figure 2, showing midvein and dispersed sclereids; stomata may be seen in clear areas. × 21. FIG. 8. Sclereids of same removed and isolated by dissection. × 61. FIG. 9. *Podocarpus distichus* var. *maialis*, from leaf of *Buchholz 1391* showing midvein and closely crowded sclereids; stomata may be seen in clear areas. × 21. FIG. 10. Sclereids of same removed and isolated by dissection. × 61.

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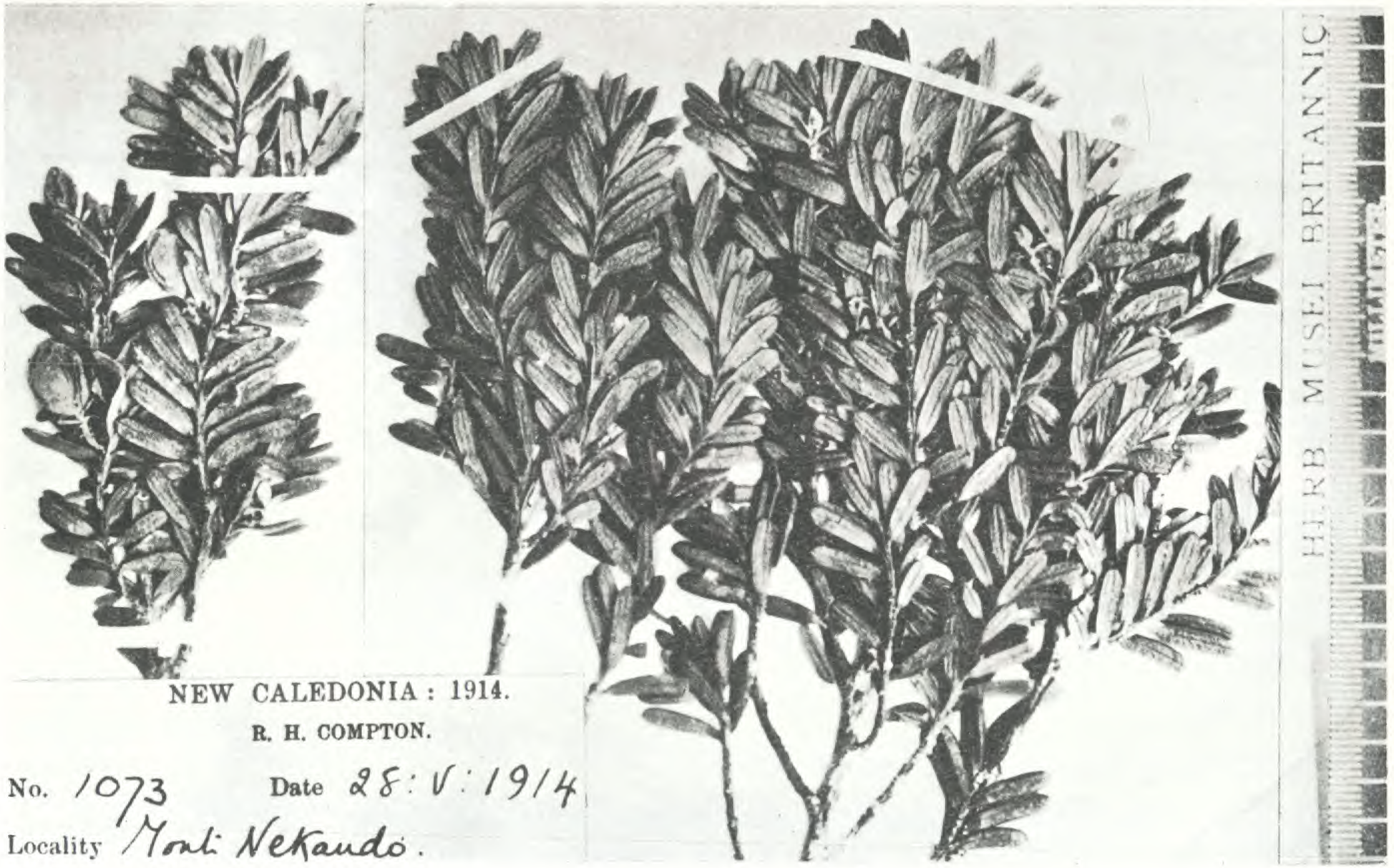
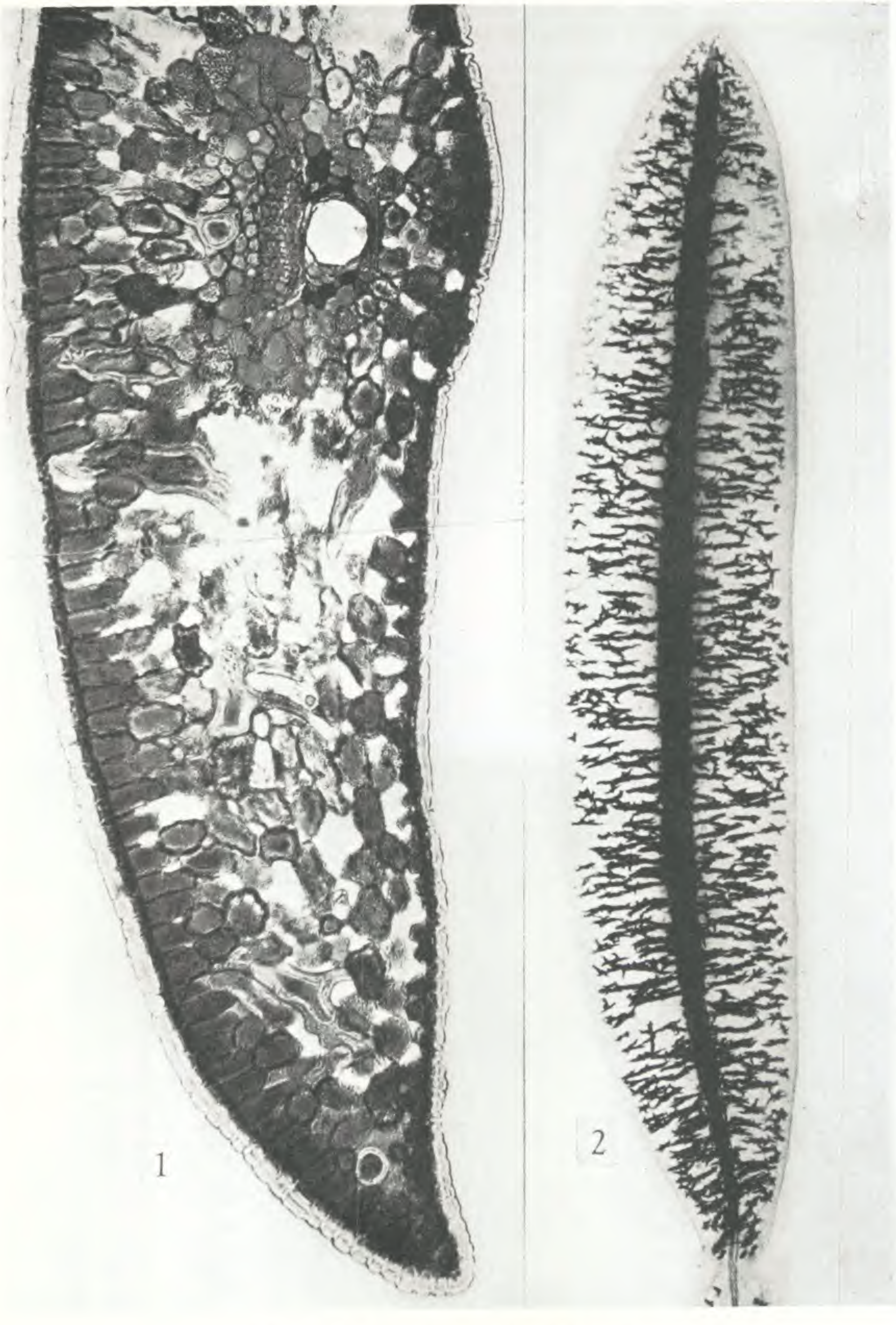


Gray & Buchholz, Podocarpus

GRAY & BUCHHOLZ, PODOCARPUS



GRAY & BUCHHOLZ, PODOCARPUS

GRAY & BUCHHOLZ, PODOCARPUS

A TAXONOMIC REVISION OF PODOCARPUS
VI. THE SOUTH PACIFIC SPECIES OF PODOCARPUS: SECTION SUNDACARPUS

NETTA E. GRAY AND JOHN T. BUCHHOLZ

THE SECTION *Sundacarpus* of *Podocarpus* is represented by the single species *Podocarpus amarus* Blume. Recently the distribution and characters of this species were outlined by Wasscher (5) with which he includes a small map (his fig. 1) showing the region in which it is found. However, Wasscher treated this species as the sole Indo-Malaysian representative of the subgenus *Stachycarpus* Endl. in the sense of Pilger (1926), while this use of the section *Sundacarpus* was set forth in a work which modified the sections of *Podocarpus,* separating those not so closely related (1).

Among the world's species of *Podocarpus* which have been extensively collected, *P. amarus* Blume, the only representative of this section, is the most singular. It is a species that may be identified by the leaf anatomy alone; in fact, only a small fragment of the leaf across the midvein would be necessary to establish the identity. Even externally this species may be recognized by the leaf, for it is the only western Pacific species of *Podocarpus* having a groove above the midvein.

To the student of phylogeny the anatomy of the leaf of this species offers much that is of special interest. It combines in a single species histological features that are common to four sections of the genus. The absence of hypoderm is a condition in common with sect. *Stachycarpus,* but the leaf is very large in comparison with any species in this section as we have defined it. The well developed accessory transfusion tissue is a character in common with the large section *Eupodocarpus.* On the other hand, the reproductive structures of *P. amarus* appear to be most closely related to sections *Nageia* and *Afrocarpus.* When all the botanical characters are considered, one is impressed by the fact that section *Sundacarpus* affords a bridge that connects several sections of this large genus.

Podocarpus amarus Blume, Enum. Pl. Javae 88. 1827, in Rumphia 3: 213. 1847; Endlicher, Syn. Conif. 217. 1847; Miquel, Fl. Ind. Bat. 2: 1073. 1856; DeBoer, Conif. Archip. Ind. 20. 1866; Carrière, Traité Conif. 667. 1867; Parlatore in DC. Prodr. 16(2): 516. 1868; Bertrand in Ann. Sci. Nat. ser. 5, 20: 67. 1874; Van Tieghem in Bull. Soc. Bot. France 38: 169. 1891; Warburg in Monsunia 1: 192. 1900; Pilger in Pflanzenreich IV. 5(Heft 18): 68. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Dallimore & Jackson, Handb. Conif. ed. 2, 39. 1931; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262. 1931; Merrill in Contrib. Arnold Arb. 8: 14. 1934; Wasscher in Blumea 4: 381. 1941; Orr in Trans. Bot. Soc. Edinburgh 34: 11. 1944.

Podocarpus Sprengelii Blume in Flora **7**: 292 (nomen.). 1824.
Podocarpus eurhyncha Miquel, Fl. Ind. Bat. **2**: 1074. 1856.
Podocarpus dulcamara Seemann in Bonplandia **9**: 253. 1861.
Nageia amara O. Kuntze, Rev. Gen. **2**: 800. 1891.
Podocarpus pedunculata Bailey in Queensland Agr. Jour. **5**(4): 390, 404. 1899; Queensland Fl. **5**: 1498, 1902; Baker & Smith, Res. Pines Austr. 441. 1910.

Large tree becoming in some places 60 m. tall, with grey bark and erect stem up to 2 m. in diameter. Branches erect to patent, becoming horizontally spreading, the twigs subverticellate, thickened and terete at base, sometimes more angular between the leaves. Terminal buds small, globose; bud scales orbicular, ovate or obovate, obtuse, up to 2 mm. long. Leaves scattered and spreading, linear-elliptic, with margins parallel over a great part of the length, cuneately narrowed at base into a short petiole, usually slightly caudate-acuminate toward the apex, 5–15 (usually 8–11) cm. long, 6–14 (usually 8–11) mm. wide or 7–11 times as long as broad; midvein usually impressed with a groove above, prominently raised and broader beneath. Leaves of juvenile specimens usually more nearly oblong-lanceolate with abruptly and strongly caudate-acuminate apex, 3.4–7 times as long as broad.

Pollen cones borne in clusters of several on short axillary peduncles or forming more compound clusters which may be on leafless twigs up to 3 cm. long, bearing 3–5 fascicles; the cones cylindrical up to 3.5 cm. long and 3.5 mm. in diameter, inserted in the axils of triangular bracts decurrent on the peduncle, surrounded at base by several other sterile scales simulating microsporophylls. The latter with two sporangia borne below a stalked triangular acute apiculus. Pollen grains winged with two air bladders. Female cones consisting of peduncles becoming 3–5 cm. long and bearing 2–3 or more divaricate ovules separated from each other by 1–2 mm. and both, together with their bracts, decurrent on the peduncle, showing scars crowded at the base and becoming more distant toward the apex. Seeds sub-globose, 1–2 maturing, with small obtuse crest, becoming 2.5–3 cm. in diameter; seed coats of two layers, an outer leathery-fleshy 3–4 mm. thick and an inner indurated layer 1.5–2 mm. thick. Seeds black-purple to red, with bluish bloom.

DISTRIBUTION: A tree of primary forests usually encountered at elevations between 800 and 2000 m. or more, in the region from the Philippine Islands south through the Netherlands Indies and New Guinea to the Cape York peninsula of Australia.

SPECIMENS EXAMINED:

PHILIPPINE ISLANDS: LUZON: Benguet Prov., *Curran 10895* (NY); Mindanao: Davao Dist., *Elmer 11539* (†F, A, †Mo, NY), *Elmer 11682* (†F, GH, A, †Mo, NY).

CELEBES: Sawito, *Boschpr. bb20785* (A).

NEW GUINEA: Morobe Dist., *Clemens 3313* (A), *Clemens 3854 bis* (A), *Clemens 5325* (A); Idenburg River, *Brass & Versteegh 13528* (†A); Owen Stanley Range, *Lane-Poole* in 1923 (†A).

SUMATRA: Simeloengoen, *Boschpr. bb20391* (NY, A); Kerintji Painan, *Boschpr. bb18743* (†A).

JAVA: Wilis, *Warburg 3513* (NY); Madium, *Koorders 29187β* (A); Ngebel, *Koorders 1217β* (†A, 2 sheets); Madioen, *Koorders 1216β* (A); Preanger, *Koorders 39352β* (A, 2 sheets); Besuki, *Koorders 14376β* (A), *Koorders 28506β* (A); G. Kendeng, *Backer 30723* (†UC); *Anon.* ex Herb. Lugd. Batav. (†BR); Reinwardt in 1826 (†BR); Blume, Rumphia III: 1. 170 (TYPE ♂) in 1847 (BR).

TIMOR: *Boschpr. bb17582* (†A).

AUSTRALIA: QUEENSLAND: *White 1338* (†NY), *Kajewski 1338* (†A), *Trist 32* (NY), *Morrotsy* in 1923 (†A, 3 sheets). CULTIVATED: Java: Hort. Bogor., *V.F. 27* (NY).

In transverse section (1, fig. 2) the leaves are characteristically with single vascular bundle, without hypoderm, but with accessory transfusion tissue well developed. The xylem and phloem are often entirely divided by the deep dorsal groove. Wings of transfusion tissue are also prominent in this species. Palisade is definite and found only on the upper surface. In our observations we have found the leaves to be hypostomatic, but Orr (2) states that "a few stomata may occur sporadically on the upper surface."

After finding that there was a difference of opinion in regard to the number of vascular resin canals in this species, we made a special study of this character. Orr (2) says of the central resin canal that "in *P. amarus* in particular it is so conspicuous a feature of the leaf section that the lateral canals, when not fully developed, are apt to be overlooked." Stiles (3) makes a similar statement regarding three resin canals in leaves referred to *P. amarus* obtained from the Royal Botanic Gardens, Kew. Thus it would seem that here the three vascular resin canals should be assigned specifically to the tree growing at Kew.*

In our careful examination of at least 18 leaves from 10 different collections from Java, New Guinea, Australia, and Philippine Islands, we have found only four which show more than one vascular resin canal and three of these require additional explanation. From New Guinea, a leaf of *Brass & Versteegh 13528* very clearly has three vascular resin canals but none of the others from this region shows more than one. One leaf from the *Morrotsy* collection from Australia shows an additional resin canal, but it is located almost under the usual large central resin canal and does not seem to be homologous with the added pair of vascular resin canals which are normally found below the region where the vascular bundle and the wings of transfusion tissue are adjacent. Sections were taken from three parts (petiole, lower part of blade, and widest part of blade) of a leaf of *Elmer 11682* from the Philippine Islands. It was found that a single resin canal was in the petiole, three in the lower part of the blade, and one in the widest part of the blade. None of the leaves from *Elmer 11539*, also from the Philippine Islands, showed more than one. However

* This specimen, searched for during the summer of 1950, was not found among numerous conifers that survived destruction due to bombing of World War II.

this specimen showed occasional large cells, with heavy walls, in the bundle sheath, once directly under the large central resin canal and half as large, often even above the vascular bundle.

In this study it was always borne in mind that a resin canal must be bordered with secreting epithelium. Close examination of the many leaves showed an occasional parenchyma cell filled with resin, heavy-walled cells as described above, and/or small spaces in the parenchyma of the bundle sheath which were found to be without epithelium and not continuous for many sections. These probably represent only air spaces or breaks caused by the preparation of the specimen or sectioning.

In view of these observations we believe that Van Tieghem (4) was not in error in his description of *P. amarus* with only a single dorsal vascular resin canal, but that the specimens he had at hand showed only one. The anatomical description of the leaf should be changed to include the fact that additional one or two vascular resin canals may rarely be developed in this species.

On both upper and lower surfaces of the leaves of *P. amarus*, the epidermal cells show a very striking pattern which results from the irregular shape and deeply wavy lateral walls. The stomata on the lower surface are isolated or in very short rows of three or four stomata. Often they are tilted as much as 45° from the longitudinal axis. There is a much higher percentage of irregularity in the subsidiary cell pattern of the stomata, there being often three or four laterally adjacent and three or four polar cells. There is a clear Florin ring present.

The presence of several names in the synonymy, based on original descriptions, might suggest the existence of more than a single species in this section. Wasscher (5), who examined Miquel's type specimen of *P. eurhyncha* Miquel, has pointed out that this description was based upon a young plant. This author has cited nearly four times as many specimens as we have found in all American collections combined and seems to have found no basis for segregating this assemblage into more than a single species. He mentions some variables such as color of the seeds, noted by collectors as varying from dark blue, bluish black to red and black, and extra large leaves, observed by some collectors to become nearly 20 cm. in length on large mature plants. Herbarium specimens with this extreme length of leaves were not seen by us, but there was considerable variation in the sizes and shapes of leaves from all regions. The name of *P. dulcamara* Seem. was based on a specimen growing in the conservatories at Kew, without reproductive parts, and is a superfluous name. Since Wasscher did not cite any specimens from Australia, we were particularly interested in seeking taxonomic differences in these which represent the southernmost area in the range of this species. The York Peninsula of Queensland in Australia was the source of the material from which *Podocarpus pedunculata* Bailey was described. But there was no essential difference from those of other regions in the specimens collected from Queensland either externally, in the leaves and reproductive parts, or

in the anatomy of the leaves. These were all found similar to specimens coming from the Philippine Islands near the northern limit of the range.

LITERATURE CITED

1. Buchholz, John T. and Netta E. Gray. A taxonomic revision of *Podocarpus*. I and II. Jour. Arnold Arb. **29:** 49–76. 1948.
2. Orr, M. Y. The leaf anatomy of *Podocarpus*. Trans. and Proc. Bot. Soc. Edinburgh **34:** 1–54. 1944.
3. Stiles, Walter. The Podocarpeae. Ann. Bot. **26:** 442–514. 1912.
4. Tieghem, P. van. Structure et affinités des *Stachycarpus*. genre nouveau de la famille des Conifères. Bull. Soc. Bot. France **38:** 162–176. 1891.
5. Wasscher, J. The genus *Podocarpus* in the Netherlands Indies. Blumea **4:** 1941.

Emory University, Georgia,
and
University of Illinois,
Urbana, Illinois.

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STUDIES IN THE BORAGINACEAE, XX
REPRESENTATIVES OF THREE SUBFAMILIES IN EASTERN ASIA

IVAN M. JOHNSTON

(*Continued from page 26*)

3. **Ehretia Dicksoni** Hance, Ann. Sci. Nat. ser. 4, **18:** 224 (1862); Kanehira, Formosan Trees ed. 2, 635, f. 592 (1936) — "In China interiori coll. Dr. Dickson, a 1861."

Ehretia macrophylla var. *tomentosa* Gagnep. & Cour., Fl. Gen. Indo-Chine **4:** 212 (1914) — type from Hainan, *Henry 8294.*

Ehretia Dicksoni var. *liukiuensis* Nakai, Jour. Arnold Arb. **5:** 40 (1924) — type from Ryukyu Islands.

Ehretia Dicksoni var. *japonica* Nakai, Jour. Arnold Arb. **5:** 40 (1924); Terasaki, Nippon Shokubutsu Zufu t. 1221 (1933) and t. 2509 (1938) — type from Japan.

Ehretia Dicksoni var. *velutina* Koidzumi, Acta Phyt. et Geobot. **10:** 140 (1941) — a comprehensive substitute name for the three varieties listed above.

Ehretia macrophylla sensu Shirasawa, Icon. Essent. Forest Trees Japan **2:** t. 69 (1908).

Tree to 12 m.; leaves elliptic or ovate to obovate-elliptic, usually 10–18 cm. long and 5–12 cm. broad, apex acute, base usually obtuse or rounded, only rarely acute or slightly subcordate, margin serrate with usually spreading triangular teeth, upper surface green, somewhat scabrous from short appressed hairs, lower surface paler with abundant soft short hairs and frequently somewhat velvety, petiole 1–3 cm. long; leaves on very vigorous shoots usually larger, broader, and more coarsely toothed, 15–20 cm. long, 8–12 cm. broad, and scantily hairy on the lower surface; inflorescence terminal, corymbose or loosely paniculate, 6–12 cm. broad, usually hairy; calyx 3–4 mm. long, usually paler and slightly indurate near base, sessile or subsessile, lobes 1.5–2 mm. long oblong; corolla white or yellowish, fragrant, 1 mm. long, tube 6 mm. long, gradually expanded, 2 mm. thick at base, to 6 mm. thick at summit, lobes 4 mm. long spreading or recurving; filaments 4–4.5 mm. long, attached 4.5–5 mm. above base

of tube, anthers oblong, 1.5–2 mm. long; style 7–9 mm. long, frequently bearing some appressed hairs, lobes 0.8–1 mm. long; drupe yellow, 10–20 mm. in diameter, depressed globose; endocarp 9–12 mm. long, 7–9 mm. broad, outer surface smooth, at maturity dividing into 2-seeded halves.

Ranging in the typical form (var. *typica*) from Kiangsu and Hunan south to northern Kwangtung, and also from southern Japan to Hainan.

KIANGSU: Pao Hwa Shan, Nanking, *V. L. King 1551* (A); Nanking, *Meyer 1415* (A).

KIANGSI: Lu Shan, *N. K. Ip 1071* and *Chung & Sun 667* (A); Kuling, *Wilson 1571* (A).

HUNAN: Sinhwa, *Handel-Mazzetti 782* (A); Yang Shan, Changning Hsien, *Fan & Li 361* (A).

KWEICHOW: Do-Wan, Chenfeng, *S. W. Teng 90859* (A); Sui-luk, southwest of Nanning, *W. T. Tsang 21940* and *21890* (A).

KWANGTUNG: Yam Na Shan, Kaying District, *W. T. Tsang 21326* (A, NY); Tsing Leung Shan, *McClure 6712* (NY).

JAPAN: Awa, Mt. Kiyosumi, 1906, *Sakurai* (A).

RYUKYU ISLANDS: without locality, *Yokohama Nursery Co.* (type of var. *liukiuensis*).

FORMOSA: Tamsuy, *Oldham 347* (G); Tansui, Taihoku-shu, *Tanaka & Shimada 10962* (A, NY); Tentana, Shinchiku prov., *Wilson 10306* (A); Bankinsing, *Henry 190* and *456* (A); Takow, *Henry 313* (A, NY); South Cape, *Henry 323* (A, NY); without locality, *Faurie 8272* and *8273* (A).

HAINAN: Hoi How, *Native Collector Hongkong Bot. Gard. 2183* (A); Kingshan, *F. C. How 71322* (A); without locality, *Ford* (A).

3A. **Ehretia Dicksoni** var. **glabrescens** Nakai, Jour. Arnold Arb. 5: 40 (1924) — type from near Ichang, Hupeh, *Wilson 3554*.

Differing from the typical form in having usually thinner, commonly elongate leaves with the lower surface glabrous or nearly so.

Ranging from Honan and Hupeh west to eastern Sikang; also known from southern Yunnan.*

HONAN: Chengchow, *J. Hers 69* (A); Yu Tai Shan, Teng Feng Hsien, *J. Hers 275* (A).

HUPEH: Patung Hsien, *H. C. Chow 526* (A, NY); Patung, western Hupeh, *Wilson 84* (A, NY); near Ichang, *Wilson 3554* (TYPE, A) and *3554A*; without locality, *Henry 1881 bis* (G), *3866* (NY), and *7171* (G); Siao Ya-tsze, *W. Y. Chun 3614* (A); Fan-sien, *Silvestri 1923* (A); Ou-tan-scian, *Silvestri 1929* (A).

SZECHUAN: Mao-chou, Min Valley, *Wilson 3554B* (A); north of Wen-chuan Hsien, *F. T. Wang 2176* (A); Mt. Tsing-cheng, Kuan Hsien, *W. P. Fang 13587* (A); Kuan Hsien, *W. P. Fang 2265* (A, NY); west of Kuan Hsien, *F. T. Wang 20904* (A); north of Chengtu Plain, *F. T. Wang 22171* and *22182* (A); Mt. Omei, *W. P. Fang 3217*, *14459*, and *16890* (A); Mt. Omei, *H. C. Chow 9725* (A) and *C. L. Chow 4746* (A);

* "*Ehretia macrophylla*" is reported by K. S. Hao, Bot. Jahrb. 68: 632 (1938) from the mountains south of Koko-Nor, in northeastern Tibet. Other collections of the same species he reports from along the Kialing Ho, above Chungking, Szechuan, and from the Szechuan-Kansu border northwest of Chaohwa, Szechuan. Possibly *E. Dicksoni* var. *glabrescens* may be represented.

Omei Shan, *Chiao & Fan 206* and *825* (A); Omei Hsien, *Sun & Chang 616* (A).

SIKANG: 10 km. from Yong-ging, *C. Y. Chiao 2101* (A); Ya-an, *C. Y. Chiao 1150* (A).

YUNNAN: Mengtze, mountain forests, 5000 ft. alt. *Henry 10515* (A, NY).

3B. **Ehretia Dicksoni** var. **tilioides**, var. nov.

Folia late elliptica plus minusve chartacea, subtus glaberrima sublucida, margine minute regulariter serrata.

Known only from Kweichow and Kwangsi.

KWEICHOW: Tungtze, *Y. Tsiang 4882* (A, NY).

KWANGSI: Nan Hung, Ling Yun Hsien, *Steward & Chco 357* (TYPE, Arnold Arboretum, ISOTYPE, NY); Nantan, *C. Wang 41189* (A).

Ehretia Dicksoni has close relatives only in *E. corylifolia* Wright of the highlands of southwestern China and *E. macrophylla* Wall. of Nepal. From both it is readily separable by its very large fruit. From *E. corylifolia* in particular it differs further in its usually less hairy, more coarsely serrate, rarely cordate leaves and coarser broader calyx-lobes and usually stouter corolla-tube. Unlike its relatives, *E. Dicksoni* is a plant of low altitudes. In its three forms it is widely distributed in the southern half of China and also on the islands to the east, from Japan to Hainan.

The type of *E. Dicksoni* lacks precise geographic data but probably came from Kiangsu through which Dickson traveled in 1861 on his overland journey from Canton to Hankow, cf. Bretschneider, Hist. European Bot. Disc. China 68 (1898). The original description calls for oblong leaf-blades pallid beneath from a short dense tomentose indument. In these as well as in other less critical details it agrees well with material I have cited from northern Kiangsi. Similar plants are known from southern Kiangsi to northern Kwangtung and west to Hunan and Kweichow and also from southern Japan to Hainan. Characteristic of the var. *typica* is the pallid tomentulose or velvety indument on the lower surface of the generally large broad leaves. This is present only on the foliage on old branches. Foliage on vigorous shoots differs in being not only larger in size, thicker, and very coarsely toothed, but also scantily hairy and even green on the lower surface. Several collections from China show this very well, cf. *Tsang 21326* and *21890, Wilson 1571*, and *Handel-Mazzetti 782* in part. Material from the Ryukyu Islands and Formosa can be matched among material from the mainland, and, though showing a greater frequency of broad rounded rather sharply serrate leaves, is not worthy of nomenclatorial recognition. The material from Japan is notable for its rounded, coarse, thick leaves, and also for the frequent development of mineralized disks at the base of the stiff scabrous hairs on the upper leaf-surface. At most it is a minor form, but whatever its merit the name *E. Dicksoni* var. *japonica* Nakai is available should its recognition prove useful.

The var. *glabrescens* Nakai is a well-marked geographical variety con-

fined to Honan, Hupeh, Szechuan, Sikang, and Yunnan. It differs from *E. Dicksoni* var. *typica* in its thinner, usually narrower and more elongate leaves, glabrous or only inconspicuously hairy beneath. Nakai based the variety on three collections without any designation of a type: 1) *Wilson 3554* from near Ichang, Hupeh, 2) *Wilson 3554B* from Mao-chou, Min Valley, northwestern Szechuan, and 3) *Henry 10515* from Mengtze, southern Yunnan. The collections are very similar. They have the lower leaf-surface bearing only a very few scattered hairs and hence apparently glabrous. Wilson's collection from Ichang, no. *3554*, has been accepted as the type. It is the extreme glabrous form, apparently the one most abundant in western Szechuan. In western Hupeh, and even about Ichang, many plants have moderate quantities of inconspicuous short hairs on the lower surface of their leaves. Such plants, however, never have the pallid, densely soft-hairy lower leaf-surfaces that are found on the foliage produced along old stems of the more easterly ranging var. *typica*. It is to be noted, however, that they can simulate in type of indument that sometimes found on the large coarse leaves produced by vigorous shoots in the var. *typica*. Characters of the var. *typica* and var. *glabrescens* are apparent, accordingly, only when foliage from mature wood is compared. Curiously, though the var. *typica* has conspicuously different foliage on soft and hard wood, no such marked dimorphy has been detected among the specimens of the var. *glabrescens* examined.

The var. *tilioides* differs from the var. *typica* in having evidently thinner, more sharply and finely serrate leaves that are completely glabrous and even somewhat lustrous beneath. Its broad, rounded, thinner and more finely serrate leaves, somewhat glossy beneath, separate it from the most glabrous forms of the var. *glabrescens*. In texture and broad rounded outline the foliage is very suggestive of *Tilia* or *Actinidia*. The three collections cited are very similar in appearance and separable at a glance from other forms of the species. Coming from a small area off to themselves they merit nomenclatorial recognition. Only fruit has been seen. Possibly the status of the plants will have to be revised when flowers have been studied. In general terms, the var. *tilioides* comes from an area lying on the western boundary of the var. *typica* and to the east and south of the area of the var. *glabrescens*.

At least two forms of *E. Dicksoni* are in cultivation. The plant of Japan is grown in France, cf. Caille & Poisson, Bull. Mus. Hist. Nat. Paris **26:** 580 (1920), sub "E. macrophylla." I have seen specimens of it from gardens in California (Bard Place, Hueneme, *Walther 301*). The plant of Hupeh, *E. Dicksoni* var. *glabrescens*, formerly grew in the Arboretum. Specimens from similar cultivated plants are at hand from "Hort. Vilmorin" and La Mortola. Hillier, Jour. R. Hort. Soc. **61:** 109, f. 17 (1936), reports it still grown in southern England. The plant growing at Toulouse, described and illustrated by Pinelle, Rev. Hort. **86:** 173–76, f. 50–51 (1914), is also the var. *glabrescens*. It is said to have been introduced by Vilmorin through seeds sent by Farges from Szechuan.

4. **Ehretia resinosa** Hance, Jour. Bot. **18**: 299 (1880); Kanehira, Formosan Trees 639, f. 595 (1936) — type from Tak-kan, Formosa, *Swinhoe*.

Ehretia formosana Hemsley, Jour. Linn. Soc. Bot. **26**: 144 (1890) — type-material from Formosa, *Wilford 539* and *Swinhoe*.

Tree; leaves ovate to elliptic or broadly lanceolate, 7–15 cm. long, 4.5–8.5 cm. broad, base usually obtuse or rounded, apex acuminate or rarely obtuse, upper surface glabrous or nearly so, more or less lustrous, when young somewhat vernicose, lower surface bearing short soft spreading hairs; petiole 1–3 cm. long; inflorescence terminal on an elongate leafy shoot and becoming oppositifolious or associated with a few reduced leaves on an abbreviated shoot from old leaf-axils, and produced just before or more commonly during period of leaf-renewal, corymbose 2–8 cm. broad, hairy and frequently glandular, at times vernicose when very young, branches dichotomous, ebracteate, borne on peduncle about 2 cm. long; calyx 4–6 mm. long, lobes lanceolate to linear-cuneate, 3.5–5 mm. long, pedicels usually 1–3 mm. long; corolla white, fragrant, 8–11 mm. long, tube cylindric, 2–2.5 mm. thick, 4.5–6 mm. long, lobes 3.5–5 mm. long, usually about 0.5 mm. shorter than the tube but rarely about as long; filaments 3–4.5 mm. long, attached 0.5 mm. below summit of tube; anthers about 2 mm. long, with a deep narrow sinus below the middle; ovary glabrous, ca. 1 mm. long; style 5–8 mm. long, lobes 1–2 mm. long; fruit 5–6 mm. in diameter; endocarp rugose, the ridges mostly very narrow, breaking up into 4 single-seeded parts.

Endemic to Formosa.

FORMOSA: Takao, Kotobukiyama, *Tanaka 10345* (A, NY); Apes Hill, Takao, *Wilson 9871* (A); Takao, *Henry 1277* (A) and *Faurie 390* (A); near Tak-kan, 1865, *Swinhoe*, photo of type of *E. resinosa* (A); Bankinsing, *Henry 1277* (A) and *Faurie 391* (A); Kosyun, *Ito 229* (A); betw. Boryo and Kuraru, Koshun, *Wilson 10967* (A); without locality, April 5, 1914, *S. Kawagoe* (A).

This Formosan tree has only one close relative, the scarcely separable *E. Navesii* Vidal (1886) of the Philippines. Among our species it is notable for its slender elongate sepals.

5. **Ehretia confinis**, sp. nov.

Arbor parva 6–10 m. alta; foliis ellipticis vel obovatis glabris 6–11 cm. longis 2.5–5.5 cm. latis, basi angustatis vel rotundis, margine integris vel rarite apicem versus sparse dentatis, subtus pallidioribus costa et nervis (utroque latere costae 4–7) evidenter donatis; petiolo 1–1.5 cm. longo; inflorescentia saepe corymbosa 4–7 cm. crassa 1–4 cm. longe pedunculata ebracteata plus minusve puberulenta et glandulifera, ramulis glabris foliatis terminata; calyce 2–2.5 mm. longo 1–5 mm. longe pedicellato, lobis oblongis 1.2–1.8 mm. longis apice obtusis rotundisve, margine inconspicue sparseque ciliolatis alibi glabris; corolla flavescenti 5.5–6.5 mm. longa, tubo 2.5–3.5 mm. longo, basi 1.5 mm. crasso deinde sursum gradatim valdeque expanso, apice 5–6 mm. diametro, lobis 3–3.5 mm. longis tubo

longioribus vel subaequilongis; filamentis 5–6 mm. longis, ca. 1.5 mm. supra basim tubi corollae affixis, antheris 1.2 mm. longis, stylo 6 mm. longo glabro, lobis ca. 1 mm. longis; ovario 1 mm. longo; endocarpio 5–7 mm. crasso, extus conspicue rugoso, intus cavitate centrali conspicua donato, maturitate in pyrenis 4 uniseminatis disrupto.

Known only from extreme southwestern China, Yunnan.

YUNNAN: Shunning, Wenkaunkuai, common tree in forest, 30 ft. tall, *T. T. Yü 16333* (A); Shweli-Salwin divide, lat. 25°45′, shrub in open situations by streams, 30–35 ft. tall, *Forrest 24311* (G); north of Ho-tou, Shweli-Salwin divide, lat. 25°30′, shrub, 20–30 ft. tall, in thickets, *Forrest 26357* (TYPE, Arnold Arboretum; NY).

A very distinct species especially notable for its moderate-sized corollas with very widely flaring tube.

6. **Ehretia Tsangii**, sp. nov.

Arbor parva, 3 m. alta; foliis glaberrimis ellipticis vel oblongo-ellipticis 10–20 cm. longis 5–10 cm. latis basi rotundis vel angulatis 1–2 cm. longe petiolatis apice acutis vel plus minusve acuminatis, margine integerrimis, nervis utroque latere costae 5–6 ascendentibus in faciebus inferioribus prominentibus; inflorescentia corymbosa ramulis foliatis terminante vel e axillis ramulis defoliatis orienti perinconspicue puberulenta et glandulifera 2–6 cm. diametro, 5–7 cm. (pedunculo brevi incluso) longo, infra medium bracteis 1–2 mm. longis caducis vel foliis reductis gesta alibi ebracteata stricte dichotome ramosa; calyce 1.5–2 mm. longo inconspicue puberulento et glandulifero, lobis ovatis 1–1.3 mm. longis margine brevissime ciliolatis; corolla alba odorata 7–8 mm. longa glabra, tubo 4–5.5 mm. longo gradatim ampliato, basi 1.5–2 mm. crasso apice 3–4.5 mm. crasso, lobis oblongis 3–3.5 mm. longis tubo brevioribus; filamentis 3–3.5 mm. longis saepissime 3–3.5 mm. supra basim tubi corollae affixis; antheris oblongis 1.2–2 mm. longis; stylo glabro 6 mm. longo, lobis ca. 1 mm. longis; fructu ignoto.

Known only from southern Kwangsi and Yunnan.

KWANGSI: mountains surrounding Pa Lau Village, Sui Luk, southwest of Nanning, fairly common, scattered shrub 3 m. tall, fl. white, fragrant, *W. T. Tsang 21888* (TYPE, Arnold Arboretum) and *21854* (A).

YUNNAN: Szemao, *Henry 13379* (NY).

A well-marked species for which I can suggest no close relationship.

7. **Ehretia Dunniana** Léveillé, Fedde Repert. 11: 65 (1912); Rehder, Jour. Arnold Arb. 15: 320 (1934) — type from Lou-fou, Kweichow, *Cavalerie 3479*.

Ehretia volubilis Hand.-Mazz., Anz. Akad. Wiss. Wien **61**: 164 (1924) and Symb. Sin. 816 (1936) — type from Manhao, valley of Red River, southern Yunnan, *Handel-Mazzetti 5895*.

A tree or scrambling shrub differing from *E. longiflora* only as follows: Leaves thinner, beneath with not only the midrib and primary veins but also the secondary and tertiary veins evident and clearly anastomosing,

usually minutely glandular beneath when young; young twigs, inflorescence and calyx densely and minutely glandular; calyx 2–3 mm. long, glandular and minutely hairy, lobes acute to obtuse, ovate to oblong or lanceolate, 1–2 mm. long; corolla 9–9.5 mm. long, glabrous or (*Henry 11797*) densely puberulent and glandular outside, tube 5–7 mm. long, lobes 3–4.5 mm. long; filaments 2–5 mm. long, attached 4.5–5 mm. above base of corolla-tube; anthers 0.9–1.5 mm. long; style 5.5–10 mm. long, lobes 1.5–2.5 mm. long.

Known only from southern China (Yunnan and Kweichow).

KWEICHOW: Lo-fou, *Cavalerie 3479*, photo of type (A).

YUNNAN: Manhao, *Handel-Mazzetti 5895*, photo of type of *E. volubilis* (A); mountains south of Szemao, *Henry 11797* (A, NY); mountain east of Szemao, *Henry 11797A* (A); Szemao, *Henry 13021* (NY); Szemao, *Henry 11797B* (NY).

A very well marked species which, though evidently related to *E. longiflora* of southeastern China, is readily distinguished by its evidently veiny leaves and glandular inflorescence.

8. **Ehretia longiflora** Champ., Hooker's Jour. Bot. & Kew Miscell. **5:** 58 (1853); Gagnep. & Cour., Fl. Indo-Chine 4: 210 (1914); Kanehira, Formosan Trees 637, f. 593 (1936); Jarrett, Hong Kong Naturalist **3:** 152 (1932); Herklots, Hong Kong Naturalist **5:** 111, t. 9 (1934) — type from Hong Kong.

Ehretia glaucescens Hayata, Icon. Pl. Formosa **3:** 153 (1913) — type from Kizan near Mai, Formosa, *Hayata & Susaki*.

Tree to 12 m. tall, deciduous; leaves glabrous, commonly broadest at or above middle, elliptic to broadly oblanceolate, 10–18 cm. long, 3–8 cm. broad, apex abruptly acuminate, base usually angled, lower surface light green with evident midrib and 4–6 pairs of primary veins, secondary veins obscure, petiole 1–2.5 cm. long; inflorescence axillary, usually numerous, produced from axillary buds on usually leafless twigs of the previous season and generally just before the period of vigorous new vegetative growth, dichotomously branched, corymbose or paniculate, bractless, 3–6 cm. broad, glabrous or minutely brownish puberulent; peduncle 1–4 cm. long, commonly bearing below the middle two early-deciduous reduced leaves 1–2 cm. long; calyx 1.5–2 mm. long, glabrous, sessile but occasionally borne terminal on short branchlets of inflorescence and hence seemingly pedicellate, calyx-lobes 0.5–1 mm. long, ovate or oblong, apex rounded, margins ciliolate; corolla white to pink, 11–13 mm. long, lobes ovate or elliptic-ovate, becoming reflexed, 2–3.5 mm. long, tube 7–10 mm. long, from base 1.5 mm. thick gradually expanding to 4–5 mm. thick at summit; filaments filiform, 7–11 mm. long, attached 3–6.5 mm. above base of tube, anthers 0.6–0.9 mm. long; ovary 1 mm. long, glabrous; style 10–15 mm. long, lobes 1–3 mm. long; drupe yellowish red to red or pinkish purple, 7–10 mm. in diameter; endocarp bony, laterally compressed, hollow at center, outside very sharply and prominently ribbed (some ribs even knife-like), at maturity breaking up into 4 single-seeded parts.

Southern China and adjacent Indo-China (Tonkin); Formosa; Hainan.

KIANGSI: Hsin Feng Hsien, *H. H. Hu 1116* (A).

KWANGTUNG: Lai Ka Shan, *Tse Hei 2* (A); Yu-Yuen, *S. P. Ko 52690* (A); Lok Chong, *C. L. Tso 20806* (A, NY); Wong Chuk I, Wung Yuen District, *S. K. Lau 2143* (A); Yang Mei Lang, Yao-shan, *S. S. Sin 9709* (NY); Shan Kai Kou, Lungchun, near Kiangsi border, *C. L. Tso 21627* (NY); Naam Kwan Shan, Tsengshing District, *W. T. Tsang 20326* (A, NY); Ngok Shing Shan, Sin-fung District, *Y. W. Taam 547* (A); Ah Po Kai Shan, Sin-fung District, *Y. W. Taam 655* (A); Nam Shan, Ho-yuen District, *W. T. Tsang 28932* (A); Hong Kong, *Y. W. Taam 2033* (A), *W. Y. Chun 4790* and *7524* (A, NY), *Y. Tsiang 725* (A), *L. Gibbs 7464* (A), *Ford s.n.* (A), *C. Wright 416* (G, NY).

KWANGSI: Yao Shan, Ping Nam, *C. Wang 39355, 39364,* and *40266* (A); Chuen Yuen, *T. S. Tsoong 82016* (A); Ling Wun, *S. K. Lau 28756* (A); Shap Man Taai Shan, Shang-sze District, *W. T. Tsang 22488* (A).

YUNNAN: Mar-li-po, Hwang-jin-in, *K. M. Feng 13004* (A).

FORMOSA: Hiiran-zan, *R. Kanehira 23* (A); Mt. Kappan, *Y. Simada* (A); Bankinsing, *Henry 432* and *563* (A); Sozan, Taihoku-shu, *Tanaka & Shimada* (A, NY); Horisha, prov. Nanto, *Wilson 11190* (A); L. Candidius, *Gressitt 233* (A, NY).

HAINAN: Yeung Ling Shan, *S. K. Lau 115* (A); Ka Chik Shan, *S. K. Lau 1712* (A, NY); Five Finger Mt., *McClure 9475* (A); Manning, *F. C. How 73196* (A); Po-ting, *F. C. How 73294* (A).

One of a group of very closely related but geographically isolated species of which the first named is the Javanese *E. javanica* Blume, Bijdr. 14: 842 (1826). The other members of this group are *E. Dunniana* of southern China and *E. Wallichiana* Hook. f. & Thoms. ex Clarke, Fl. Brit. India 4: 143 (1883), of eastern India and Burma. *Ehretia javanica* differs from our plant only in having more rounded, more evidently veined, broadly elliptic leaves. The Indian *E. Wallichiana* has thinner, much more evidently veined leaves, a larger (3–3.5 mm. long) calyx, and a corolla with shorter (5–6 mm.) tube and longer (3–4.5 mm.) lobes, and larger (1.7 mm. long) anthers.

The Chinese plants referable to *E. longiflora* are reasonably uniform. I have detected only one minor geographically correlated variation. Coastal plants, typical *E. longiflora,* usually have minutely pubescent inflorescences, whereas those on plants of more interior localities have them glabrous. Plants of Formosa and Hainan differ from those of the mainland only in having the corollas slightly thinner in texture and perhaps also in their more slender filaments.

9. **Ehretia asperula** Zollinger & Moritzi in Moritzi, Verzeichn. Zollinger Pfl. 52 (1846) — type from Java, *Zollinger 1548.*

Ehretia Hanceana Hemsl., Jour. Linn. Soc. Bot. **26:** 145 (1890); Gagnep. & Cour., Fl. Indo-Chine **4:** 207 (1914) — type from Hainan.

Scandent shrub, clambering to 5 m.; twigs with minute brownish pubescence when young and frequently also with scattered bristles (0.2–0.5 mm. long) arising from bulbose bases, usually glabrate in age; leaves coriaceous, elliptic to oblong-elliptic or obovate-elliptic, 5–15 cm. long,

2–7 cm. broad, at maturity glabrous or with a minute inconspicuous brownish pubescence on the petiole and along the midrib beneath, apex obtuse or abruptly short-acuminate, base rounded or obtuse, margin usually entire but occasionally with few to numerous small to coarse irregular teeth, petiole 7–20 cm. long, frequently somewhat tuberculate and bristly; inflorescence terminal on elongate leafy twigs, minutely brownish pubescent, corymbose or broadly paniculate, 5–20 cm. broad, dichotomously much branched, axis and branches and branchlets bearing scattered persistent curved linear bracts 3–10 mm. long, leafless or bearing a few reduced leaves towards the base; calyx 1.5–2.5 mm. long, commonly borne on a slender stiffish pedicel 1–3 mm. long; corolla white or pink, 3.5–5 mm. long, tube 1.2–2 mm. long, lobes 2–3 mm. long; filaments attached about 1 mm. above base of tube, 4–5 mm. long; anthers 1 mm. long; style 3–4 mm. long, lobes 1 mm. long; drupe red, orange or yellow, 3–4 mm. in diameter; endocarp rugose, breaking up into 4 single-seeded parts.

Known only from Hainan, northern Indo-China, and Java.

HAINAN: Po-ting, *F. C. How 73256* (A); Lingshui, *F. C. How 73769* (A); Pat Ka Shan, *C. I. Lei 1173* (A); Ko Leng, *S. K. Lau 529* (A); Kingtung, *S. K. Lau 27923* (A); Bo-ting, *S. K. Lau 28192* (A); Tung Koo Shan, *H. Fung 20392* (A, NY) and *20408* (A, NY); without locality, *C. Wang 34611* (A, NY); without locality, *Henry 47* (G), *8027* (G), and *8186* (G); Hoi-how, *Bullock* (BM, photo); Hoihow, *Hancock 30* (K, photo); without locality, *Sampson* (K, photo).

INDO-CHINA: Tourane, Annam, *Clemens 4335* (A); Kau Nga Shan, Tien-yen, Tonkin, *W. T. Tsang 30503* (A); Sai Wong Mo Shan, Lomg Ngong Village, Tonkin, *W. T. Tsang 30341* (A).

JAVA: without locality, *Zollinger 1548* (ISOTYPE of *E. asperula*, G.).

Distinctive of this species, and aiding in recognizing it, are the persistent curved linear bracts borne scattered throughout the inflorescence. Another unusual feature of the plant is its scandent habit of growth. The leaves in this species, furthermore, show unusual variability as to leaf-margin. Though on most branches the leaves are all entire, on some one or more leaves may have the margin toothed in varying degrees. When present the toothing is erratic in distribution and irregular as to size and form. Occasionally it becomes very coarse and almost capable of description as lobulate-dentate. The type collection of *E. asperula* has conspicuously and coarsely toothed foliage. *Ehretia Hanceana* was based upon specimens having entire leaves. It represents the most common form of the species on Hainan.

10. **Ehretia laevis** Roxb., Pl. Coromandel 1: 42, t. 56 (1795); Gagnep. & Cour., Fl. Indo-Chine **4:** 208 (1914) — type from India.

Ehretia laevis var. *platyphylla* Merrill, Lingnan Sci. Jour. **14:** 55 (1935) — type from Hainan, *Lau 323*.

Tree to 10 m.; leaves ovate-elliptic or obovate or even suborbicular, 6–18 cm. long, 5–11 cm. broad, rounded or angled at base and apex, above somewhat lustrous when mature, below minutely glandular-pubescent

when young, but except for some hairs in the vein-axils becoming glabrous at maturity, petiole 1–2.5 cm. long; inflorescence appearing just before leaf-renewal and usually maturing fruit as new leaves expand, terminal and axillary, loosely dichotomous, 5–15 cm. broad, with a few bracts on the primary axis but otherwise naked, ultimate branches bearing the sessile flowers unilaterally in two crowded ranks, hence somewhat scorpioid and particularly so just before anthesis; calyx 1–2 mm. long, sessile or subsessile, tawny tomentulose; corolla white, 2.5–3.5 mm. long, subrotate, not conspicuous; tube open, 0.7–1.5 mm. long; lobes 2–2.5 mm. long, recurving; filaments attached 0.5–1 mm. above base of corolla-tube, anthers 0.5–0.7 mm. long; style 2–3 mm. long, lobes as much as 1 mm. long; drupe yellow or orange, 3–4 mm. in diameter, endocarp rugose, breaking up at maturity into 4 single-seeded parts.

Hainan, Indo-China, Burma, and India.

HAINAN: Loktung, *S. K. Lau 27149* (A); Bak Sa, *S. K. Lau 26485* (A); Yaichow, *F. C. How 70328* (A, NY); Naam Shan Leng, *S. K. Lau 323* (A); I Kap Shan, *S. K. Lau 1143* (A, NY) and *6025* (A); Lok Mooi Shan, *S. K. Lau 1289* (A, NY); Ka Chik Shan, *S. K. Lau 1521* (A, NY), *1541* (A, NY), and *2856* (A); Ue Lung Shan, *S. K. Lau 3209* (A); Chim Fung Ling, *S. K. Lau 3386* (A) and *5149* (A); without locality, *H. Y. Liang 63558* (A, NY), *64138* (A, NY), *65125* (A, NY), *65223* (A, NY), *65304* (A, NY), *66427* (A, NY), and *66445* (A, NY).

The tree of Hainan is obviously conspecific with the Indian *E. laevis*. Though the latter usually has appreciably larger corollas, its smaller-flowered forms are indistinguishable from our plant of Hainan.

11. **Ehretia hainanensis,** sp. nov.

Arbor 8 m. alta inflorescentia inconspicue puberulenta alibi glaberrima; ramulis gracilibus elongatis laevibus; foliis chartaceis integerrimis elongatis aliquantum asymmetricis 7–15 cm. longis 2.5–5 cm. latis lanceolatis medium vel supra medium latioribus, apice valde acuminatis, basi acutis vel obtusis 1.5–3 cm. longe graciliterque petiolatis, subtus opacis, venis primariis prominulis utrinque latere costae 4–6, venis secondariis et tertiaribus inconspicuis sub lente reticulum laxum prominulum formantibus; inflorescentiis axillaribus et terminalibus (e ramulis foliatis hornotinis erumpentibus) laxe dichotomis 1–4 cm. latis, ramulis fertilibus sparsis ebracteatis 1–2 cm. longis crassiusculis, pedunculo 1–3 cm. longo bracteis sparsis 1–3 mm. longis donato; floribus sessilibus secundis laxe inconspicueque biseriatis; calyce 1.3–1.5 mm. longo, lobis ovatis tubo subaequilongis; corolla 4.2–4.5 mm. longa alba, tubo 2 mm. longo basi 1–1.3 mm. crasso, apice ad 2.5 mm. crasso, lobis ellipticis 2.2–2.5 mm. longis recurvatis; filamentis 3 mm. longis gracilibus 1 mm. supra basim tubi corollae affixis, antheris 0.8 mm. longis; ovario glabro 1 mm. longo; stylo 3–3.5 mm. longo, 1–1.3 mm. profunde lobatis; fructu ignoto.

HAINAN: Yaichow, tree 8 mm. tall in forest, flower greenish white, 1200 ft. alt., Dec. 1932, *N. K. Chun & C. L. Tso 44626* (TYPE, Arnold Arboretum; ISOTYPE, NY).

Related to *E. laevis* Roxb. and its allies, but readily distinguished by having thin, elongate, slender-petiolate, somewhat asymmetric leaves, as well as loose, not distinctly scorpioid inflorescences that are borne on elongate new leafy twigs, and not on branches of the previous season. Merrill & Chun, Sunyatsenia 2: 315 (1935), have reported the type-collection as representing *Ehretia canarensis* Miq. That, however, is a plant of the high mountains of southern peninsular India, very closely related to *E. laevis*, and differing from our plant in the characters enumerated for *E. laevis*.

12. **Ehretia dichotoma** Blume, Bijdr. 14: 842 (1826) — type from Java.

Tree to 15 m.; specimens usually darkening in drying; branchlets slender, smooth, glabrous, and even somewhat glaucous; leaves lanceolate or somewhat oblanceolate to elliptic-oblong, entire, glabrous, 6–15 cm. long, 2–5 cm. broad, base acute to broadly acute, apex acute and slenderly attenuate, above somewhat glossy; petiole 7–10 mm. long, slender; inflorescence mostly axillary, with very slender axis and branches, produced on elongate new shoots bearing numerous well-developed leaves, glabrous or minutely and scantily puberulent and sometimes minutely glandular, 2–7 cm. long, 2–5 cm. broad, usually loose and open, dichotomous; peduncles 1–3 cm. long, below the middle usually bearing one or a few minute bracts and commonly producing short fertile branches from their axils; flowers sessile or subsessile or some of the lowermost on slender pedicels up to 3 mm. long, usually secund along the slender branches of the inflorescence; calyx 1.5 mm. long, lobes oblong to cuneate, 0.5–0.7 mm. long, glabrous or inconspicuously puberulent or glandular; corolla white, 3.5–4.5 mm. long, texture thin, tube 1.5–2 mm. long; lobes 2–3 mm. long, recurving, longer than the tube; filaments 2 mm. long, attached 1.5 mm. above base of tube; anthers 0.7–0.9 mm. long; style 2–3 mm. long, lobes to 1.3 mm. long; drupe 3–5 mm. in diameter, "yellow"; endocarp rugose, breaking up at maturity into 4 single-seeded parts.

Indo-China, Malaya, Andaman Islands and Java.

INDO-CHINA: Saigon, etc., *Pierre* (A).
MALAY PENINSULA: Pulau Timun, *Henderson 29115* (A).
ANDAMAN ISLANDS: Port Monat, 1895, *King's Collector* (A).

This tree has been reported from Indo-China as "E. laevis var. canarensis," Fl. Indo-Chine 4: 209 (1914), and from Malaya as "E. laevis," King & Gamble, Fl. Malay. 18: 283 (1905), and as "E. Timorensis" Ridley, Fl. Malay. 2: 442 (1923) or "E. laevis var. timorensis," Clarke, Fl. Brit. Ind. 4: 142 (1883). The plant is readily distinguished from both *E. laevis* Roxb. and *E. canarensis*. In our plant the much more slenderly branched inflorescences arise from the axils along very smooth leafy twigs representing vigorous recent growth, whereas in *E. laevis* and *E. canarensis* the inflorescences arise from the axils along roughened and verrucose twigs of the previous season just before leaf-renewal.

6. HELIOTROPIUM L.

Heliotropium L., Sp. Pl. 130 (1753) and Gen. Pl. 130 (1754) — type-species, *H. europaeum* L.

Annual or perennial, herbaceous or more or less shrubby; leaves small to large, sessile or petiolate; cymes unilateral and generally distinctly scorpioid, with or without bracts; corolla white, yellow, or purple, variable in form, throat frequently pubescent inside; anthers included, filaments extremely short; style present or absent; stigma usually frustrum-like or conic, mostly sterile, receptative only in a band around the base; fruit dry, at maturity breaking up into 4 single-seeded or 2 biseminiferous nutlets; seeds usually with a thin endosperm.

A large genus widely represented in the warmer parts of the world. The species are particularly numerous in arid regions. Most are herbs or lowly suffruticose plants. The native species of tropical Asia are nearly all members of the section *Orthostachys*, the largest section in the genus and certainly the most perplexing and confused. The group is in great need of careful study and revision. In applying names to the species in our area I have followed what has become traditional usage. It is to be expected that this nomenclature will be altered, at least in part, when the group gets the monographic attention it deserves.

Two members of *Heliotropium* are known to be cultivated in our area. The Peruvian *H. arborescens* L. (*H. peruviana* L.) is a well-known ornamental garden plant in Japan, Formosa, and China. In addition, a collection of *H. europaeum* L. is at hand from Peiping (*T. P. Wang 314*, NY), where it is noted as being cultivated in Prince Park in August 1931.

KEY TO THE SPECIES

Leaves large, evidently veined, 2–10 cm. broad; fruit glabrous, strongly ribbed, cleft with the lobes divergent; corolla blue or violet, tube very elongate, lobes imbricate in the bud. § *Tiaridium*.....1. *H. indicum.*

Leaves smaller, not evidently veined; fruit hairy, convex, before breaking up into nutlets not evidently lobed, not ribbed; corolla white or yellowish, tube not surpassing calyx, lobes involute and erect in the bud. § *Orthostachys.*

Inflorescence bractless, the slender scorpioid cymes frequently borne in pairs; stigma sessile on ovary; stem-leaves with slender petiole 5–12 mm. long.....2. *H. ovalifolium.*

Inflorescence with bracts, the cymes borne singly; stigma elevated on a short style; stem-leaves sessile or with petioles less than 3 mm. long.

Cymes at maturity becoming slender and very elongate, 2–10 cm. long, with flowers very loosely arranged and not evidently 2-ranked, bracts slender and elongate.....3. *H. strigosum.*

Cymes at maturity less than 4 cm. long, dense, with flowers crowded in two ranks, bracts elliptic.

Leaves 2–5 mm. broad, 8–20 mm. long, the lowermost evidently opposite; calyx-lobes lanceolate, attenuate; corolla not much surpassing the calyx; stigma twice as long as broad.....
.....4. *H. marifolium.*

Leaves 1–2 mm. broad, 3–4 mm. long, all alternate; calyx-lobes oblong or ovate, acute; stigma thrice as long as broad; corolla evidently surpassing the calyx.....5. *H. formosanum.*

1. **Heliotropium indicum** L., Sp. Pl. 130 (1753); Clarke, Fl. Brit. India 4: 152 (1883); Gagnep. & Cour., Fl. Indo-Chine 4: 220 (1914) — "Habitat in India utraque."

Coarse annual herb, 2–10 dm. tall, becoming loosely branched, more or less bristly especially on the younger parts; leaves ovate to elliptic, abundantly and evidently veined, 4–15 cm. long, 2–10 cm. broad, apex acute, base usually rather abruptly contracted into a well-developed partially winged petiole 2–10 cm. long, margin usually repand or undulate; inflorescence ebracteate, the slender and elongate scorpioid cyme becoming 1–3 dm. long, usually borne singly; flowers crowded in two ranks; calyx herbaceous, 2.5–3 mm. long, sparingly bristly, lobes cuneate to lanceolate, somewhat unequal; corolla salverform, blue or violet, rarely white, limb 3–4 mm. broad, lobes rounded, broader than long, imbricate in the bud, corolla-tube cylindric, evidently longer than the calyx, 3–4.5 mm. long; anthers 0.7–0.9 mm. long, free from one another, borne about the middle of the corolla-tube, filaments very short and slender, attached 1–1.5 mm. above base of tube; ovary glabrous; style 0.5–0.7 mm. long, usually thickening above the middle; stigma broader than long, truncate, 0.3–0.5 mm. in diameter at base; fruit glabrous, deeply bilobed, lobes mitre-like, ribbed, strongly divergent, cleft at the apex, each lobe eventually dividing into a pair of angulate pointed one-seeded nutlets.

Southern China, Ryukyus, Formosa, Hainan, Indo-China; an amphigean weed now widely distributed in the warmer parts of the world; probably American in origin.

FUKIEN: Hinghwa, *Lin Pi 6001* (G).

KWANGTUNG: Honam Island, *Levine 668* (G); Tinghushan, *T. N. Liou 1502* (NY).

YUNNAN: Fo-Hai, *C. W. Wang 74884* (G); Cha-li Hsien, *C. W. Wang 81143* (G).

RYUKYU ISLANDS: Naha, Okinawa, *Boehmer 22* (NY).

FORMOSA: Towapi, *Yamamoto 2357* (NY); Koshun, *Tanaka 5428* (NY); without locality, *Henry 309* (NY).

HAINAN: Chung Ngo Shan, *S. K. Lau 3263* (G); Fung Leng, *S. K. Lau 474* (G); Tai Tin Shan, *S. K. Lau 1296* (G); Fan Ta, *Gressitt 705* (G); Loktung, *S. K. Lau 26726* (G); Tai Un, *McClure 7771* (G).

INDO-CHINA: Dalat, Anam, *R. W. Squires 750* (G); Haiphong, Tonkin, *Balansa 918* (G).

2. **Heliotropium ovalifolium** Forsk., Fl. Aegypt. 38 (1775); Clarke, Fl. Brit. India 4: 150 (1883); Gagnep. & Cour., Fl. Indo-Chine 4: 222 (1914) — type for Egypt.

Herb 1–4 dm. tall, usually annual, with a grayish indument of slender pallid appressed hairs; stems usually several, decumbent or ascending, commonly branched below the middle; leaves numerous, elliptic to obovate or oblanceolate, 1–3(–6) cm. long, 4–12(–27) mm. broad, margin

narrowly revolute, apex rounded or obtuse, base obtuse to acute, midrib evident but veins rarely visible; petiole slender, on lowermost leaves nearly as long as the blade, on middle cauline leaves about a fourth as long as the blade; spikes slender, completely bractless, in pairs or less commonly single or ternate, 1–12 cm. long, with very numerous crowded small flowers in two ranks, scorpioid; calyx 1.5–2 mm. long, subsessile, lobes strigose, unequal, cuneate to broadly lanceolate or even ovate; corolla white, 2.5–3 mm. long, limb 2 mm. broad, tube 1.5 mm. long, inside with coarse short hairs above the middle, lobes ovate or oblong, 0.5–0.8 mm. long, infolded and erect in the bud; anthers 0.7 mm. long, lanceolate, acuminate, remaining distinct, attached by an extremely short filament about 0.5 mm. above the corolla-base; ovary glabrous; style none; stigma sessile, about 0.3 mm. thick, length slightly greater, appendage conic, apically bidentate; fruit rounded, about 1.5 mm. high, slightly pointed, with appressed hairs, breaking up into 4 equal nutlets; nutlets on inner faces with inconspicuous circular depressions, caruncular scar-tissue usually massed on one side of the inner angle.

Indo-China: widely distributed in the Old World tropics.

INDO-CHINA: Mekong, *Thorel 2043* (G).

A species very closely related to *H. procumbens* Mill. (*H. inundatum* Sw.) of the American tropics.

3. **Heliotropium strigosum** Willd., Sp. Pl. 1[2]: 743 (1798). — "Habitat in Guinea."

Lithospermum chinense H. & A., Bot. Beechey Voy. 202 (1836); Spengler, Oesterr. Bot. Zeitschr. **68:** 120 and 123, t. 2, f. 37 (1919); Hand.-Mazzetti, Symb. Sin. **7:** 818 (1936) — type from Macao, *Vachell 286.*

Plant with many very slender prostrate or ascending stems, becoming fruticulose towards the base; indument whitish but thin, strigose, the hairs pallid, very closely appressed, slender, 0.5 mm. long or less; stems scantily branched below the middle, 1–3 dm. long; leaves small and very numerous, lance-linear, 3–15 mm. long, 0.3–1.6 mm. broad, apex acute, base rather abruptly contracted into a slender petiole 0.5–1 mm. long, midrib somewhat impressed above, prominent below, margin usually revolute; inflorescence at anthesis a moderately crowded unilateral cyme, not conspicuously bracteate, in fruit slender, elongate, 2–8 cm. long, with flowers loose and only very obscurely if at all two-ranked, bracts 1–3 mm. long, usually strict and inconspicuous; calyx 3 mm. long, sparsely strigose outside, lobes lanceolate or cuneate, green and contrasting with the pale pedicel and calyx-base; pedicel in fruit 1–2 mm. long, strict, angulate, apparently long decurrent on the stem; corolla white, somewhat strigose outside, 3–5 mm. long, tubular or funnelform; lobes oblong or very short and broad, erect and somewhat involute in the bud, sinus broad and rounded, plicate; throat inside minutely glandular and puberulent at the summit; anthers ovate-lanceolate, 0.75 mm. long, tips thickened and coherent; filaments 0.5 mm. long, attached 0.5 mm. above base of corolla-tube; ovary glabrous; style distinct, 0.4 mm. long; stigma 0.5 mm.

long, with a distinct stigmatic disk about 0.3 mm. in diameter and a superimposed narrowly conic sterile appendage; fruit rounded, depressed, with short closely appressed hairs above the middle, breaking up into 4 equal nutlets; nutlets about 1 mm. high, the inner faces both with a central circular depression, the small caruncle on inner angle usually downwardly prolonged.

Southeastern China and Hainan; India and eastward in the East Indies; Africa.

FUKIEN: Amoy Island, on sand bar, *Steward 3041* (G, NY); near Diongloh, along way to Sie Su, *Chen Ping En 2369* (G).

KWANGTUNG: Swatow, Sept. 1901, *Dalziel* (G).

MACAO: dunes along coast, *Hance 1441* (G).

HAINAN: Yaichow, open sandy places, *H. Y. Liang 62845* (G); Manning, grassy place, *F. C. How 71479* (G); Kumyun, *S. K. Lau 27789* (G); Sam Ah, open sandy regions, *N. K. Chun & C. L. Tso 43312* (G); Lam Ko District, sandy, *C. L. Lei 1272* (G); Po Fu Ling, sand, *C. I. Lei 1044* (G); Tung Koo Shan, sand, *H. Fung 20417* (G); Singshui-Sunchuanking, *H. Y. Liang 61802* (G); seashore, *C. Wang 33785* (G); without locality, *Henry 8158;* Yaichow, sand by seashore, *F. C. How 70937* (G); Sam Ah, open sandy places, *N. K. Chun & C. L. Tso 43312* (G).

INDO-CHINA: western Tonkin, *Abbe Bon 5685* (G).

Our material agrees reasonably well with the variable plant of India passing as *H. strigosum* but differs in details from that of Africa, and especially from that of west Africa, and so, presumably, from the type of the species.

4. **Heliotropium marifolium** Retzius, Obs. Bot. 2: 8 (1781) — type from India?

Plant at first erect and 10–15 cm. tall but later usually depressed with widely spreading or prostrate much-branched stems 1–3 dm. long, thinly clad with loosely appressed stiff straight pallid hairs about 1 mm. long; leaves numerous, lanceolate to elliptic, 0.8–2 cm. long, 2–5 mm. broad, earliest ones opposite but later ones all alternate, midrib impressed above and very prominent beneath, margin usually loosely revolute, apex acute, base obtuse or acute; petiole 0.5–2 mm. long; inflorescence at first leafy and glomerate, in fruit a crowded biseriate scorpioid cyme 1–3(–4) cm. long; bracts spreading, foliaceous, numerous, lanceolate, 3–4 mm. long; calyx 2–4 mm. long; lobes appressed hispid, lanceolate, becoming enlarged and ovate-lanceolate in fruit; pedicels in fruit very short and stout, 1 mm. long or less; corolla white, 2.5–3.5 mm. long, not much surpassing the calyx, limb hairy outside, lobes poorly developed, short but very broad, obtuse, erect and infolded in the bud; throat at summit densely villulose; anthers 0.7 mm. long, lance-ovate, their tips thickened and coherent; filaments 0.2 mm. long, attached 0.5–0.7 mm. above base of corolla; ovary glabrous; stigma 0.5 mm. long, consisting of a stigmatic disk 0.3 mm. in diameter and a superimposed narrowly conic sterile appendage; style 0.2–0.3 mm. long, short but evident; fruit depressed and rounded, bearing

short thickish hairs on the upper half, breaking up into 4 equal nutlets; nutlets 1–1.5 mm. high, the inner faces about equal and each with a small circular depression, a small caruncular mass usually present at the middle of the angulate inner edge.

Hainan, Indo-China; India to New Guinea.

HAINAN: Loktung, *S. K. Lau 26779* (G); Kumyun, grassy place, *S. K. Lau 27784* (G).

INDO-CHINA: ad montem Krervanh in prov. Pusath in Cambodia, *Pierre 1221* (G).

5. **Heliotropium formosanum**, sp. nov.

Planta decumbens vel prostrata minute sparseque griseo-strigosa ut videtur perennis; caulibus 1–2.5 dm. longis pluribus suffruticulosis gracilibus laxe ascendente ramosis basi 1.5 mm. crassis, internodiis caulis 1–2 mm. longis; foliis parvulis numerosissimis 3–4 mm. longis 1–2 mm. latis ellipticis vel ovatis divaricatis, apice late acutis, basi obtusis vel subrotundatis, subtus costa prominenti donatis, infimis 1 mm. longe petiolatis ceteris subsessilibus, superioribus vix reductis; spicis densis apice ramulorum foliosorum numerosorum solitariis obscure scorpioideis 4–8-floris 8–15 mm. longis bracteis foliosis ovatis vel ellipticis 2–3 mm. longis donatis; calyce 2.5–3 mm. longo subsessili extus pilis 0.3–0.6 mm. longis sparsis adpressis vestito intus subglabro; lobis valde inaequalibus acutis 0.5–1.2 mm. latis tubum corollae breviter superantibus; corolla alba 3.5–4 mm. longa, tubo 1.5 mm. longo medium versus 0.8–1 mm. crasso apice modice constricto, limbo ad 4 mm. diametro, lobis ovato-triangularibus 1 mm. latis, sinibus late obtusis plicatis, faucibus subvelutinis pilis minutis erectis numerosis donatis; antheris ovato-lanceolatis 0.6–0.7 mm. longis supra medium valde attenuatis apice cohaerentibus; filamentis gracilibus perbrevibus 0.4–0.6 mm. supra basim corollae affixis; ovario glaberrimo; stylo ca. 0.5 mm. longo, stigmate 0.7–0.8 mm. longo anguste conico triplo longiori quam lato; fructibus convexis 1–1.2 mm. altis supra medium pilis brevibus adpressis sparsis donatis; nuculis 4 in faciebus interioribus foveolatis angulo interiore medium versus cicatricatis.

FORMOSA: South Cape, *A. Henry 956* (TYPE, NY).

Because of its slender loosely branching stems and numerous small leaves, this plant is at first glance suggestive of *H. strigosum* Willd. Actually, however, it is most closely related to *H. marifolium*, from which it differs in its slender loosely branched stems, extremely abundant minute mostly subsessile leaves, lack of opposite leaves and branches, slightly denser indument of shorter, more slender grayish hairs, less attenuate calyx-lobes, more elongate stigma, and more exserted corolla. The proportionately broad leaves and bracts, sessile fruiting calyces, and dense short inflorescence quickly distinguish it from *H. strigosum*. The proposed species comes from the tropical south end of Formosa and so from a locality northward from and well beyond the northern limit of *H. marifolium*.

7. TOURNEFORTIA L.

Tournefortia L., Sp. Pl. 140 (1753) and Gen. Pl. ed. 5, 68 (1754) — type-species, *T. hirsutissima* L.

Tetrandra (DC.) Miquel, Fl. Nederl. Ind. **2:** 928 (1858) — type-species *T. tetrandra* Blume.

Shrubs, frequently scandent; leaves generally broad and with evident petiole; inflorescence usually dichotomous, terminal or axillary, bearing the flowers in scorpioid cymes; corolla with short or elongate tube, lobes spreading, frequently conduplicate; stamens mostly included, filaments generally very short; drupe with very juicy watery mesocarp, usually white; endocarp usually breaking up into 1- or 2-seeded pyrenes; stigma irregularly globular and broadly receptative laterally or receptative only in a band about the base and above sterile and commonly somewhat bi-lobed.

A genus composed chiefly of scandent shrubs. The great majority of the species and the greatest intrageneric diversity occur in the American tropics. For a synopsis and complete synonymy of the twelve species of the Old World see Johnston, Jour. Arnold Arb. **16:** 145–161 (1935).

Key to the Species

Mature endocarp breaking up into 4 single-seeded pyrenes; stigma elevated above ovary on a short but distinct style; Formosa . . 1. *T. sarmentosa.*

Mature endocarp breaking only in half, forming a pair of 2-seeded pyrenes; stigma broadly affixed and sessile on the rounded top of ovary; south China, Indo-China and Hainan . . . . . 2. *T. montana.*

1. **Tournefortia sarmentosa** Lam., Tab. Encyc. **1:** 416 (1791); Johnston, Jour. Arnold Arb. **16:** 147 (1935) — type probably from the East Indies.

Scandent shrub; leaves ovate or elliptic to lanceolate, usually minutely verrucose from an abundance of tiny protruding cystoliths, 6–12 cm. long, 2.5–5 cm. broad, base obtuse or rounded, with a petiole 5–20 mm. long, apex acute and frequently somewhat acuminate, upper surface usually sparsely strigose, usually with appressed veins, lower surface paler, usually with short spreading hairs but at times velutinous or even nearly glabrous; inflorescence terminal on leafy shoots, loosely dichotomous, bearing pairs of slender densely flowered bractless scorpioid cymes usually 1–3 cm. long; calyx sessile 1–1.5(–2) mm. long, strigose, lobes lance-ovate or lanceolate; corolla white, 3–12 mm. long, somewhat strigose on outer surface, limb 2.5–4.5 mm. in diameter, lobes rounded, folded, 1–2 mm. broad, tube subcylindric 1–1.5 mm. thick or when elongate somewhat ampliate and about 1 mm. thick at base and 2 mm. thick above middle; anthers 0.3–2 mm. long, subsessile, attached 0.7–4 mm. above base of corolla; ovary glabrous or with a very few hairs on upper part, somewhat bottle-shaped, elongate, 0.4–0.5 mm. thick, from base to tip of stigma 1.5–2 mm. long, distinctly narrowed above middle and continuing into a

short but distinct style; stigma a somewhat irregular globular or subcylindric mass no more than twice the diameter of the style, at times obscurely bilobed at summit; drupe white, about 5 mm. in diameter; endocarp sulcate on four sides, at maturity breaking up into 4 single-seeded pyrenes.

Formosa and south through the Philippines and the Celebes and from Java to New Guinea and northeastern Australia.

FORMOSA: Anping, Tainan, *Wilson 9904* (A); Arisan Prov., *Wilson 10896* (A); Takao, *Faurie 389* (A); Bankinsing, *Faurie 388* (A); Koshun, *Yanagawa 3* (A).

An extremely variable species as to flower size and as to size, shape, and pubescence of foliage. The capacity for foliar variation is well demonstrated in the Philippines, but only moderately so at the extreme northern limit of its range in Formosa. In flower size and shape, however, the Formosan plants appear to be as inconstant as in other regions. Of the collections cited above four have corollas 3–4 mm. long and anthers 0.3–1 mm. long. One collection (*Faurie 3891*), however, has the corollas 11–12 mm. long and anthers 1.5–2 mm. in length. Although differing greatly in the length of the corolla and particularly in the more elongate tube and anthers, the collections are otherwise similar and especially so in ovary, style, stigma, and fruit. Because of its variation in foliage and corolla size the species has accumulated a large number of synonyms. A listing of them will be found in the paper by Johnston cited above.

2. **Tournefortia montana** Loureiro, Fl. Cochinchin. 1: 122 (1790); Merrill, Trans. Am. Philos. Soc. n. s. **24**[2]: 330 (1935); Johnston, Jour. Arnold Arb. **16**: 153 (1935) — type from Cochinchina.

Tournefortia Sampsoni Hance, Jour. Bot. **6**: 330 (1868) — type from Sai-chü-shan, prov. Canton, *Sampson 13035*.

Tournefortia Boniana Gagnepain, Not. Syst. **3**: 33 (1914) and Fl. Indo-Chine **4**: 217 (1914) — type material from Tonkin, *Bon 1932* and *1357*.

Tournefortia Gaudichaudii Gagnepain, Not. Syst. **3**: 34 (1914) and Fl. Indo-Chine **4**: 217, f. 26 (1914) — type from Tourane, Indo-China, *Gaudichaud 180*.

Tournefortia brachyantha Merrill & Chun, Sunyatsenia **2**: 314, f. 43 (1935) — type from Ngai Yuen, Hainan, *F. C. How 70424*.

Scandent shrub; leaves lanceolate or rarely ovate-lanceolate, 8–15 cm. long, 2–6 cm. broad, base acute to rounded, apex acute and usually slenderly acuminate, above scantily and minutely strigose, frequently minutely dotted by cystoliths, commonly with impressed veins and midrib, below paler, strigose, with prominent veins; petiole 2–15 mm. long; inflorescence terminal on leafy shoots, loosely dichotomous, bractless, the flowers borne crowded in 2–10 slender scorpioid cymes usually 2–15 cm. long; calyx sessile, 1–2.5 mm. long, with appressed hairs, lobed ½ to ⅔ to base, lobes lanceolate; corolla white to greenish or yellowish, 5–12 mm. long, sparsely strigose outside, limb 2.5–6 mm. broad, lobes 1–1.5 mm. long, 1–2 mm. wide, conduplicate, tube about 1 mm. thick at base, expanding to 1.8–2.5

mm. thick at middle and again contracted at the throat; anthers oblong-linear 1.5–2.7 mm. long, subsessile or rarely with filament up to 0.4 mm. long, attached 1–2.5 mm. above base of corolla-tube; ovary glabrous, somewhat ovoid, terminated by a large broadly affixed sessile discoid stigma; drupe subglobose, about 5 mm. in diameter; endocarp conspicuously grooved only dorsally and ventrally, eventually breaking to form plano-convex halves, each containing 2 seminiferous cavities and an intervening sterile one.

Southern China, Hainan, and Indo-China.

YUNNAN: Szemao, Yulo forests, 4000 ft. alt., large climber, fl. yellow, *Henry 12862* (A, NY).

KWANGTUNG: in umbrosis inter rupis porphyriticas, ad cavernulas Sai-chü-shan, prov. Cantoniensis, April 1866, *T. Sampson 13035* (A, ISOTYPE of *T. Sampsoni*).

HAINAN: Yaichow, *F. C. How 70424* (A, ISOTYPE; NY, TYPE of *T. brachyantha*); Wong-Po Por, Kum-Yun District, *H. Y. Liang 65208* (A, NY); Pak Shik Ling, *C. I. Lei 664* (A, NY); Ka Chik Shan, *S. K. Lau 1425* (A, NY).

INDO-CHINA: Lan kok, Mont Bair, Tonkin, *Balansa 3891* (A); Long-Tcheou, Tonkin, *Dr. Simond* (A); O Cach, in monte Ma Dong, Feb. 22, 1883, *H. Bon* (A); Kemarath, Laos, *Thorel 2986* (A).

As here defined *T. montana* is restricted to plants of Indo-China, southern China, and Hainan. In a previous discussion of the species, l.c., it was given a broader definition and included also plants of Siam, Burma, and eastern India. These latter, however, differ from typical *T. montana* in having the discoid stigma not broadly attached and sessile on the rounded summit of the ovary, but elevated on a stout but still distinct stylar prolongation of the ovary. In other respects the eastern and western forms of *T. montana* appear to be similar. The plants ranging from Siam to India can be distinguished under the name **T. montana** var. **Griffithii**, comb. nov. (*T. viridiflora* var. *Griffithii* Clarke, 1883). The stout short style characteristic of them is evident in the flowering state and usually on the maturing fruit also.

Like *T. sarmentosa*, the present species is notable for wide variation in flower size and form, and in size, shape, and indument of the leaves. Flowers on a given plant are uniform in size and form, but from plant to plant they vary from 6 to 12 mm. or more in length. Specimens with corollas of intermediate size are very much less common than those with the corolla either very large or very small. Certainly a strong tendency towards corolla dimorphy is indicated. Such dimorphy is frequently associated with heterostyly or functionally unisexual flowers. As far as can be determined, this does not seem to be so in the present case. Possibly we may have floral differences associated in some manner with different seasons of the year. The problem merits the attention of the field botanist, who can also supply detailed observations on color and size of fruit and color of the flower, information needed for the complete description of the species.

8. MESSERSCHMIDIA L. ex Hebenstreit

Messerschmidia L. ex Hebenstreit, Nov. Comm. Acad. Sci. Imp. Petrop. 8: 315, t. 11 (1763) — type-species, *Tournefortia sibirica* L.

Argusia Amman, Stirp. Rar. Ruth. 29 (1739) — type-species, *Tournefortia sibirica* L.

Mallotonia (Griseb.) Britton, Ann. Missouri Bot. Gard. 2: 47 (1915) — type-species, *Tournefortia gnaphalodes* R. Br.

Trees, shrubs, and herbs; leaves large to small, usually narrowed to their attachment or at times with an inconspicuous true petiole; inflorescence ebracteate, dichotomously branched, bearing flowers in unilateral cymes; corolla white, with cylindric or campanulate tube and spreading limb, lobes conduplicate in bud; anthers on very short filaments, mucronulate at apex; stigma frustrum-like, about as tall as thick, receptative in a ring about the base, sterile portion thick and somewhat lobed; fruit dry when mature, mesocarp vesicular, corky, endocarp dividing into two parts, each with two seminiferous cavities; the fertile cavities in each half of the endocarp separated by a deep groove or by a sterile cavity.

A discussion of the complicated nomenclatorial history of *Messerschmidia* and a synopsis of the species belonging to the genus has been recently published, Jour. Arnold Arb. 16: 161–166 (1935). Recently, Jour. Arnold Arb. 30: 129–30 (1949), I weakened in my belief that the group merited separation from *Tournefortia,* but now, after a new study, I am again convinced that it should be excluded from that genus. I am now of the belief that *Messerschmidia* has its closest relations not with *Tournefortia,* but rather with *Heliotropium*. Its distinctive feature is the firm vesicular corky mesocarpial tissue in which the endocarp is embedded in the mature fruit. In *Tournefortia* the well-developed mesocarp is very juicy. Though conspicuous in the fresh state, upon drying it so shrinks about the endocarp that commonly it almost seems to disappear, or at any rate gives little evidence of its former size and very pulpy nature. In *Heliotropium* the mesocarp is not differentiated, the endocarps being covered at maturity only by thin epicarp. As a result the fruit is dry and hard.

KEY TO THE SPECIES

Plant an herb, stems arising from a strong rhizome; leaves less than 6 cm. long; inflorescence a loose unilateral cyme; calyx pedicellate, lobes cuneate or lanceolate; fruit pubescent, sunken in at summit; endocarps large and relatively thin-walled, with knife-like ridges on back and sides, covered with corky mesocarp; Japan and China. . 1. *M. sibirica.*

Plant a tree with coarse branches, leaves 10–20 cm. long; flowers sessile, in scorpioid cymes; calyx-lobes oblong, obtuse; fruit glabrous, plump and globular; bearing the relatively small thick-walled endocarps above the middle, surrounded and supported by much corky mesocarp; Ryukyus to Hainan. . . . . 2. *M. argentea.*

1. **Messerschmidia sibirica** L., Mant. 2: 334 (1771) — type from "Locus in glareosis aridisque apricis Argun fluuii et Iike Dalai Noor

in Dauria," i.e., from the headwaters of the Argun River in extreme eastern Mongolia.

Tournefortia sibirica L., Sp. Pl. 141 (1753).

Messersmidia Argusia L., Mant. **1:** 42 (1767) — same type as preceding.

Messerschmidia Arguzia Murray, Syst. Nat. ed. 13, p. 161 (1774); Linn. f., Suppl. Pl. 132 (1781).

Tournefortia Arguzia (L.) R. & S., Syst. **4:** 540 (1819); Maxim., Mel. Biol. **8:** 539 (1872).

Messerschmidia rosmarinifolia Willd. ex R. & S., Syst. **4:** 544 (1819) — type from "E. Siberia, *Pallas.*"

Tournefortia Arguzia var. *rosmarinifolia* (Willd.) Turcz., Bull. Soc. Nat. Moscow **23**[1]**:** 498 (1850).

Tournefortia Arguzia α *latifolia* DC., Prodr. **9:** 514 (1845). — "In glareosis apricis Dahuriae ad flumen Argun . . ., in siccis et salsis Siberiae ad Irtysch (*Ledeb.*)." Apparently the typical variety.

Messerschmidia siberica var. *latifolia* (DC.) Hara, Enum. Spermat. Japan **1:** 178 (1948).

Tournefortia Arguzia var. *angustior* DC., Prodr. **9:** 514 (1845) — based upon collections from China, Mongolia, Caspian area, Asia Minor and the Ukraine; "foliis lanceolatis."

Tournefortia Arguzia var. *cynanchoides* Turcz. ex Steven, Bull. Soc. Nat. Moscow **24**[1]**:** 559 (1851) — an herbarium name associated with material from Mongolia.

Heliotropium japonicum Gray, Mem. Am. Acad. ser. *2*, **6:** 403 (1859) — type from Hakodate, Japan, *Wright.*

Tournefortia siberica var. *grandiflora* H. Winkl., Fedde, Repert. Beihefte **12:** 472 (1922) — type from Peking, *Limpricht 2432.*

Herb with a strong underground rhizome, usually densely strigose or hispid-villous especially when young, stems single or clustered, erect to decumbent, simple or with a few ascending branches, 1–4 dm. tall, 1–5 mm. thick; leaves linear to lanceolate or oblong or oblong-obovate, thickish, 1–6 cm. long, 1.5–2.5 cm. broad, appressed hispid-villose or strigose, the hairs commonly thickened at base, apex of blade rounded to acute, base acute, subsessile or sessile; midrib evident, usually impressed on upper surface, prominent on lower; veins few, ascending, frequently inconspicuous, secondary veins very obscure; inflorescence terminal, dichotomous, composed of one-sided cymes, usually corymbosely arranged or glomerate, commonly 2–5 cm. in diameter, very shortly projecting above the leaves; peduncle 0–5 cm. long; corolla funnelform, 10–14 mm. long, appressed hairy outside especially on the tube, tube 1.5–3 mm. thick, subcylindric, 5–7 mm. long, lobes ovate or oblong, conduplicate, separated by plicate obtuse or rounded sinus; anthers 2–3 mm. long, oblong, the apex thickened, mucronulate; filaments very short, attached 2.5–3.5 mm. above base of corolla tube; ovary glabrous at anthesis, depressed globose, somewhat 4-sulcate, 1–1.5 mm. thick, 0.7–1.2 cm. high, seated on a thin nectariferous disk, above abruptly narrowed into a thick style 0.5–1 mm. long; stigma frustrum-like, about 1 mm. high and nearly as thick, truncate, with thick basal receptative ring surmounted by an obscurely lobed thick

sterile appendage; fruit ellipsoidal or ovoid, somewhat strigose, sunken in at summit and there bearing the inconspicuous persisting style and stigma, at maturity dry, 9–12 mm. long, 7–10 mm. thick, dividing in half along the nearly plane dorso-ventral commissure, each half with two seminiferous cavities separated by a slightly smaller frequently incomplete sterile cavity; endocarp with only moderately thickened walls, bearing knife-like wings on back and sides; mesocarp vesicular, corky, usually about 1 mm. thick on back and sides of endocarp.

Ranging from Japan across northern China and westward to Roumania and central Russia; most frequent in sandy places and generally where the soil is somewhat moist and saline.

MANCHURIA: Chinchon, near Darien, *Dorsett & Morse 5854* (G).

HOPEI: vicinity of Pekin, *David* (G), *F. T. Wang 20117* (G), *20230* (G) and *20327* (G); Hsiaowutaishan, *C. W. Wang 61455* (G); Chang-pei Hsien, *C. W. Wang 62315* (G); Yu-tien Hsien, *Meyer 944* (G).

SHANTUNG: Tsing tao, *C. Y. Chiao 2496* (G); Loo Shan to Pai Ying Tung, *C. Y. Chiao 2773* (G); Chefoo, *T. N. Liou 1507* (G) and *W. Perry* (G).

CHEKIANG: Ning-po, Chuan-shan, *K. K. Tsoong* (G).

KOREA: Port Vhusan, 1859, *C. Wilford* (G); without locality, *R. Oldham 585* (G).

MONGOLIA: Shararakh Usu, Outer Mongolia, *R. W. Chaney 58* (G); Tounet, Sartchy, *David 2604* (G).

SHANSI: without locality, *T. Tang 727* and *1202* (NY).

KANSU: Chungwei, *R. C. Ching 213* (G).

JAPAN: Hakodate, Hokkaido, 1861, *Maximowicz* (G); Hakodate, *Wright* (G, TYPE of *H. japonicum*); Samani, Hidoka, Hokkaido, *K. Mayabe* (G); Zenibako, Ishikari, Hokkaido, *Tokubuchi* (G); Tatara, Kasuya, Fukuoka, Kyushu, *T. Tanaka 197* (G) and *K. Ichikawa 237* (G).

Herbarium material of the species shows rather wide variation in size of plant and in size and shape of foliage. Some of this variation may be associated with the age of the individual. Hebenstreit, who described and illustrated individuals kept under observation in the garden at St. Petersburg, states that the leaves are linear-lanceolate, crowded, stiff, and pubescent early in the growing season but later becomes thrice larger, greener, less rigid, and less crowded. Some of the specimens before me show reductions readily recognizable as ecological. Indeed fruiting plants which are of small size and have small narrow leaves all seem to have come from dry situations. The most luxuriant forms come from sandy places along the ocean in Japan, Amur, Korea, and northern China. They are the plant described as *Heliotropium japonicum*. The name *M. sibirica* var. *latifolia* has been applied to this very robust and also generally decumbent coastal plant, but nomenclatorially it is the same as *M. sibirica* var. *typica* and consequently properly applicable only to the moderately robust form of the species common in the interior across northern China. Plants with linear leaves have been described as *M. rosmarinifolia* Willd. The description suggests that they may represent the vernal form of the species

mentioned by Hebenstreit. I have been able to detect no well-marked geographic varieties. Possibly the eastern and western forms of the species may differ somewhat in fruit. The eastern plants usually have two knife-like ridges (one lateral and one dorsal) arising from the endocarp and embedded in corky mesocarp over each of the seminiferous cavities. In western plants these ridges are poorly developed or absent. Possibly the inner surface of the calyx-lobes may be more hairy in the western plants.

The species is among the very first of the Chinese Boraginaceae to be described by Europeans. For a more complete listing of its synonyms see Johnston, Jour. Arnold Arb. 16: 161–64 (1935).

2. **Messerschmidia argentea** (L.) Johnston, Jour. Arnold Arb. 16: 164 (1935).

Tournefortia argentea L., Suppl. Pl. 133 (1781); Clarke, Fl. Brit. Ind. **4:** 145 (1883); Safford, Contr. U. S. Nat. Herb. **9:** 389, t. 69 (1905); Gagnep. & Cour., Fl. Indo-Chine **4:** 215 (1914); Kanehira, Formosan Trees 641, f. 597 (1936) — type collected on Ceylon by *König.*

Tournefortia arborea Blanco, Fl. Filip. 129 (1837) — type from Negros Island, Philippines.

Shrub or spreading tree, 1–10 m. tall; leaves large, coarse, somewhat fleshy, closely placed at the ends of stout branches, densely clad with appressed silky white hairs (indument grayish white when fresh but changing to golden in the herbarium), blade 10–20 cm. long, 4–8 cm. broad, broadly oblanceolate, broadest well above middle and gradually narrowed downwards into the stout petiole (5–25 mm. long), apex obtuse or somewhat rounded; inflorescence terminal, coarse, stiff, at first more or less glomerate but becoming loosely paniculate and somewhat pyramidal, commonly 9–18 cm. in diameter and nearly as long, borne on a peduncle 5–15 cm. long, dichotomous; flowers very numerous, at first glomerate but after anthesis displayed in crowded two-ranked elongating paired scorpioid cymes 2–10 cm. long; calyx 1.5–2 mm. long, sessile, parted, lobes fleshy oblong to nearly orbicular, densely appressed hairy outside, glabrous inside, not much enlarged in fruit; corolla white, limb 4–7 mm. broad, lobes ovate-orbicular, margin entire or somewhat denticulate, base abruptly narrowed, outer surface strigose down middle, tube shorter than lobes, campanulate, usually 1.5–2 mm. long; anthers ovate-oblong, usually about 1.5(0.5–1.8) mm. long, commonly half extruded from the open corolla-throat, apex acute, thickened, mucronulate at the very tip; filaments very inconspicuous, attached 0.4–0.8 mm. above base of corolla-tube; ovary glabrous, subglobose, 0.8–1.5 mm. thick; stigma about as long as broad, sessile, composed of a thick stigmatic disk surmounted by a pair of stout oblong appendages; fruit when mature dry, smooth, glabrous, depressed globose, 5–8 mm. in diameter, upper part occupied by the bony endocarp, the remainder corky mesocarp, eventually dividing into plano-convex halves; endocarp with relatively thick hard walls, 2–4 mm. long, back smooth and rounded, each half containing 2 ovuliferous cavities and a small interposed sterile one.

Ryukyu, Formosa, Pratas, Hainan, and Indo-China; a common strand tree in the South Pacific, ranging south to northern Australia and west to Africa; rare on the continents, usually confined to the vicinity of beaches and almost exclusively to islands.

RYUKYUS: Okinawa, near Naha, *Wilson 8181* (A).

FORMOSA: Sansendai, near Shinkô, *Yamamoto 2356* (NY); South Cape, *Henry 332* (NY).

HAINAN: Yaichow, *F. C. How 70918* (A, NY); Yin Ling Harbor, *N. K. Chun & C. L. Tso 43305* (A, NY); without locality, *C. Wang 34789* and *65447* (A).

This species is a strand plant with a fruit admirably adapted for wide dissemination by ocean currents. As such it has been discussed in some detail by H. B. Guppy, Plants, Seeds and Currents 247–51 (1917).

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

STUDIES IN THE THEACEAE, XXI
THE SPECIES OF THEACEAE INDIGENOUS TO THE UNITED STATES

CLARENCE E. KOBUSKI

With four text-figures

SINCE THE FAMILY THEACEAE is known to prefer the tropical and subtropical regions of the world, one may expect to find only a small representation of the family in the United States — and these select few on the very fringe of our limited subtropical range.

There are three genera, *Stewartia, Gordonia,* and *Franklinia,* found in this country, and these are represented by four species, two being allotted to the genus *Stewartia*. *Franklinia* is monotypic and American. *Stewartia* and *Gordonia,* on the other hand, are primarily tropical Asiatic genera.

In Index Kewensis twenty names have been allotted to *Stewartia,* eleven of which are in roman type signifying accepted species. *Gordonia* shows eighty names, over fifty of which appear as accepted species. Neither of these two genera has ever been thoroughly studied as a whole, and it is quite likely that in a future detailed study the reduction in the number of species will be considerable. It is the intention of this author to devote considerable time shortly to these Asiatic representatives. However, for this study the oriental species were considered only generally and are not included here. No matter what a further study of the groups reveals, the names given in this paper will survive for these genera, since the original descriptions of all three were based on American material.

The four species recorded in this study appear to be very well known, and, as the citation of the literature which follows attests, have appeared often in print. A wealth of material has been made available by the various institutions recorded below. The abbreviations used in this paper are as follows: (AA) = Arnold Arboretum; (Ch) = Chicago Natural History Museum; (G) = Gray Herbarium; (Mo) = Missouri Botanical Garden; (NY) = New York Botanical Garden; and (US) = United States National Museum.

In keeping with my practice in previous papers, I am including as complete a citation of literature for the species as has been available to me at the Arnold Arboretum. Actually this is by no means complete, since new references, sometimes in obscure publications, are being encountered daily. However, I have tried to include all the more available works.

A noticeable contrast may be noted in the literature cited for the genera. More complete citations will be given in the following papers, when the Asiatic material is studied in detail. The Asiatic synonyms were checked in this paper only to ascertain their relationships with the accepted genera.

As to specimens, well over four hundred have been studied. I have included most of these, reducing the space occupied by the citations as much as possible by omitting all details except the general locality, the collector and number, and the herbaria where the specimens are deposited.

KEY TO THE GENERA

A. Seeds prolonged into a pronounced oblong wing at one end; foliage coriaceous, persistent.....1. *Gordonia.*

AA. Seeds wingless (a light membranaceous margin in *Stewartia ovata*); foliage membranaceous, deciduous.

B. Capsule dehiscing loculicidally from above and septicidally from below; columella present, persistent.....2. *Franklinia.*

BB. Capsule dehiscing loculicidally from above only, no basal dehiscence; columella absent.....3. *Stewartia.*

1. GORDONIA Ellis

Gordonia Ellis in Phil. Trans. London **60:** 518, *t. 11.* 1771.

Anthecischima Korthals, Verh. Nat. Gesch. Bot. ed. Temminck 137, *t. 27.* 1840.

Carria Gardner in Calcutta Jour. Nat. Hist. **7:** 7. 1847.

Dipterospermum Griffith, Notulae Pl. Asiaticas **4:** 564. 1854.

Polyspora Sweet, Hort. Brit. ed. 1, 61. 1861.

Nabiasodendron Pitard in Act. Soc. Linn. Bordeaux **57:** liv. 1902.

TYPE SPECIES: *Gordonia Lasianthus* (L.) Ellis.

Flowers hermaphroditic with a light convex receptacle. Sepals 5, coriaceous, unequal, often gradually grading into the petals, usually deciduous, occasionally persistent. Petals 5, deciduous, joined at the base. Stamens numerous; filaments long, joined at the base and adnate to the base of the corolla, rarely united at the base in a ring-like shallow-lobed cup; anthers introrse. Ovary 3–5(rarely 6)-celled, with several ovules in each cell; style one, either long or short, with a 3–5-lobed stigma. Capsule woody, with a persistent columella, dehiscing loculicidally from the apex. Seeds 2–8 in each cell, flat or compressed, the woody testa produced upwards into an elongated, usually oblong wing.

Trees or shrubs with alternate coriaceous persistent leaves. Flowers large, solitary, axillary with 2–5 caducous bracts.

Gordonia Lasianthus (L.) Ellis in Phil. Trans. London 60: 518, *t. 11.* 1771. — Linnaeus, Mant. 550. 1771. — Cavanilles, Diss. Bot. 5: 307, *t. 161.* 1787. — Walter, Fl. Carol. 177. 1788. — Lamarck, Encycl. Meth. Bot. **2:** 770. 1788. — L'Heritier, Stirp. Nov. 156. 1791. — Swartz, Obs. Bot. 271. 1791. — Lamarck, Ill. 3: *t. 594.* 1797. — Willdenow, Spec. Pl. 3: 840. 1800. — Michaux, Fl. Amer.-Bor. **2:** 42. 1803; ed. 2, **2:** 42. 1820. — Sims in Curtis's Bot. Mag. **17:** *t. 668.* 1803. — Duhamel, Arb. & Arbust. ed. 2, **2:** 236, *t. 68.* 1804. — Desfontaines, Hist. Arb. 1: 484. 1809. — Dumond-Courset, Bot. Cult. ed. 2, **5:** 107. 1811. — Michaux f., Hist. Arb. For. Amér. Sept.

3: 131, *t. 1.* 1813. — Pursh, Fl. Amer. Sept. 1: 451. 1814. — Nuttall, Gen. N. Amer. Pl. 2: 84. 1818. — Eaton, Man. Bot. ed. 1, 78. 1817. — Michaux, N. Amer. Sylva 2: 138, *t. 58.* 1818. — Elliot, Sketches Bot. 2: 171. 1822. — Reichenbach, Fl. Exot. 3: *t. 151.* 1835. — De Candolle, Prodr. 1: 528. 1824. — Colla, Hort. Repul. 62. 1824. — G. Don, Gen. Syst. 1: 573, *fig. 99.* 1831. — J. C. Loudon, Arb. & Fruct. Brit. 1: 379, *fig. 93.* 1838. — Torrey & Gray, Fl. N. Amer. 1: 223. 1838. — Gray, Gen. Ill. 2: 102, *t. 140, 141.* 1849. — Darby, Bot. S. States 256. 1855. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève 14: 139 (Mém. Ternstr. 51). 1855. — Chapman, Fl. South. U. S. ed. 1, 60. 1860. — Curtis, Geol. & Nat. Hist. Surv. N. Carol. 3: 14. 1867. — Baillon, Hist. Pl. 4: 230, *fig. 254, 255.* 1873. — Loudon, Trees & Shrubs 73, *fig. 110.* 1875. — Goodale & Sprague, Wild Fl. Amer. 194. 1882. — Sargent, Forest Trees N. Amer. 10th Census 9: 25. 1884. — Baillon, Dict. Bot. 2: 725, *fig.* 1886. — Watson & Coulter in Gray's Man. Bot. North U. S. ed. 6, 96. 1890. — Sargent, Silva N. Amer. 1: 41, *t. 21.* 1891. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 185, *fig. 93.* 1893. — Dippel, Handb. Laubholzk. 3: 32, *fig. 20.* 1893. — Koehne, Deutsche Dendrol. 414. 1893. — Gray, Syn. Fl. N. Amer. 1: 293. 1897. — De Wildeman, Ic. Selectae Hort. Thenensis 2: *t. 41.* 1900. — Lounsberry, South. Wild Fl. & Trees 338, *t. 107.* 1901. — Small, Fl. SE U. S. 794. 1903; ed. 2, 1913. — Sargent, Man. Trees N. Amer. 678, *fig. 553.* 1905. — Hough, Handb. Trees N. States & Canada 352. 1907. — Britton & Shafer, N. Amer. Trees 705. *fig. 650.* 1908. — Robinson & Fernald in Gray's Man. Bot. ed. 7, 571. 1908. — Schneider, Ill. Handb. Laubholzk. 330. 1909. — Apgar, Orn. Shrubs U. S. 80, *fig. 52.* 1910. — Bean, Trees & Shrubs Hardy Brit. Isles 1: 597. 1914; ed. 3, 1921. — Rehder in Bailey, Stand. Cyclop. Hort. 3: 1361. 1915. — Bailey, Man. Cult. Pl. 501. 1924; ed. 2, 673. 1949. — Melchior in Nat. Pflanzenfam. ed. 2, 21: 137, *fig. 63.* 1925. — Rehder, Man. Cult. Trees & Shrubs, ed. 1, 624. 1927. — Small, Man. SE Fl. 877, *fig.* 1933.

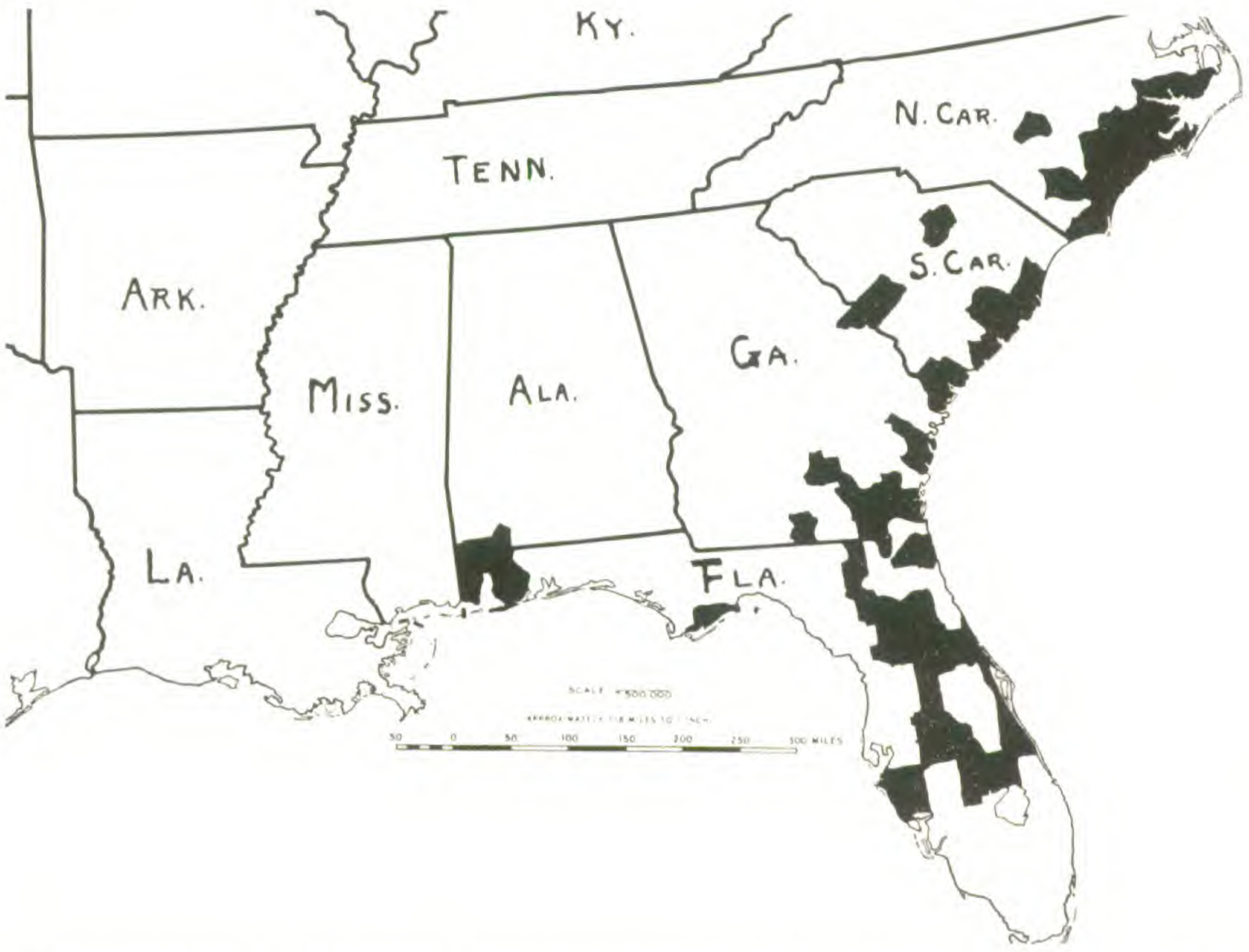
Hypericum Lasianthus Linnaeus, Spec. Pl. 783. 1753; ed. 2, 1101. 1762. — Hill, Veg. Syst. 15: *t. 1, f. 3.* 1769.

Alcea Floridana quinque capsularis, Laurinis foliis, leviter crenatis, seminibus conifcrarum instar alatis Catesby, Nat. Hist. Car. Fla. & Bah. Islands 1: 44, *t. 44.* 1754.

Gordonia pyramidalis Salisbury, Prodr. Stirp. Chap. Allert. 386. 1796. *Lasianthus pyramidalis* (Salisbury) O. Kuntze, Rev. Gen. Pl. 1: 63. 1891.

Tree 20–30 m. high (occasionally a shrub); the trunk straight 0.4–0.5 m. in diam.; branches upright at first, then spreading forming a compact head; bark of mature tree brown, as much as 2.5 cm. thick, deeply divided into ridges. Leaves coriaceous, persistent, glabrous, lanceolate to oblong-lanceolate to elliptic, 10–15 cm. long, 2.5–5 cm. wide, acute at the apex, cuneate near the base, then long-decurrent (1.5 cm.) to the sessile or subsessile base, the margin serrate along the upper half of the leaf, rarely below the middle, the midrib lightly canaliculate above, elevated beneath,

the veins up to 15 pairs, rather inconspicuous. Flowers solitary, axillary; pedicel terete, glabrous, red, 5–8 cm. long, thickening toward the apex; bracteoles 4, below calyx, quickly caducous; calyx-lobes 5, imbricate, subcoriaceous, deciduous, orbicular to suborbicular, ca. 1 cm. long, densely covered on external surface with a dense velvety pale lustrous pubescence, the margin ciliate with long pale hairs; petals 5, white, incurved, rounded at the apex, contracted at the base, ca. 3 cm. long, 1.5–2.5 cm. wide, silky-puberulent on the exterior surface; stamens numerous, the filaments united at the base, forming a shallow deeply 5-lobed cup, pubescent on the inner surface and adnate to the base of the corolla, the free part of the filaments ca. 5 mm. long; ovary ovoid, pubescent, gradually contracted into a stout persistent style, 5-celled, the ovules 4–8 in each cell, the style elongated, erect, the stigma 5-lobed. Capsule subligneous, ovoid, acute at the apex, 1.5–2 cm. long, ca. 1 cm. diameter, 5-celled, dehiscing loculicidally with a persistent angled central axis. Seeds winged at one end, ca. 1 cm. long, slightly concave on the inner surface, concave on the outer surface.



TEXT-FIGURE 1. Geographical distribution of *Gordonia Lasianthus* (L.) Ellis by counties, based on the herbarium specimens studied.

SPECIMENS EXAMINED:

NORTH CAROLINA: BEAUFORT CO.: *R. K. Godfrey 5399* (G). BLADEN CO.: *W. W. Ashe 2396* (NY), *s. n.* (Mo, US); *R. K. Godfrey 5977* (G); *A. A. Heller 14091* (Ch, Mo); *H. J. Oosting & H. L. Blomquist 33647* (G). BRUNSWICK CO.: *E. B. Bartram s. n.* (G); *K. M. Wiegand &*

W. E. Manning 1978 (G). CARTERET CO.: *C. V. Morton 2206* (US); *L. F. & F. R. Randolph 836* (G). CRAVEN CO.: *T. G. Harbison 22* (AA). DUPLIN CO.: *M. E. Hyams s. n.* (US). HARNETT CO.: *L. R. Gibbs s. n.* (NY). HYDE CO.: *P. O. Schallert s. n.* (NY). LENOIR CO.: *L. F. & F. R. Randolph 790* (G). NEW HANOVER CO.: *Biltmore Herb. 3908* (AA, G, Mo, NY, US); *R. K. Godfrey 4678* (G, NY, US). ONSLOW CO.: *H. L. Blomquist 11276* (Mo). PAMLICO CO.: (*M.*) *G. McCarthy s. n.* (Ch, US). PRECISE LOCALITY LACKING: *W. H. Brown s. n.* (US); (*M.*) *G. McCarthy s. n.* (Ch, G, US).

SOUTH CAROLINA: AIKEN CO.: *H. Eggert s. n.* (Mo). BEAUFORT CO.: *J. H. Mellichamp s. n.* (AA, Mo, US); *J. H. Ravenel s. n.* (G). BERKELEY CO.: *K. M. Wiegand & W. E. Manning 1979* (G). CHARLESTON CO.: *F. C. Prince s. n.* (G). GEORGETOWN CO.: *R. K. Godfrey & R. M. Tryon 673* (G, Mo, NY, US). KERSHAW CO.: *S. D. McKelvey s. n.* (AA). JASPER CO.: *C. Mohr s. n.* (Mo, US).

GEORGIA: BRANTLEY CO.: *E. T. Wherry s. n.* (AA, G). CAMDEN CO.: *R. M. Harper 1571* (AA, Ch, G, Mo, US). CHARLTON CO.: *F. Harper s. n.* (US); *N. Hotchkiss & L. E. E. 3386* (US). COFFEE CO.: *R. M. Harper 693* (NY, US). LIBERTY CO.: *T. G. Harbison s. n.* (AA); *J. K. Small s. n.* (NY). LOWNDES CO.: *J. K. Small s. n.* (AA, NY). MCINTOSH CO.: *T. G. Harbison 5935* (AA); *H. H. Smith 2804* (Ch). RICHMOND CO.: *A. Curtiss s. n.* (NY); *J. D. Smith s. n.* (G, US). WARE CO.: *Helbard Cypress Co. s. n.* (AA, Mo).

FLORIDA: ALACHUA CO.: *T. G. Harbison 90* (AA). BREVARD CO.: *A. S. Rhoads 8336* (AA). COLUMBIA CO.: *A. H. Hitchcock s. n.* (Ch); *J. E. Layne 16* (Mo). DUVAL CO.: *A. H. Curtiss 405* (AA, Ch, G, Mo, NY, US), *4884* (AA, G, Mo, US), *9964* (Mo), *s. n.* (Ch, US); *H. D. Keeler s. n.* (NY). FRANKLIN CO.: *T. Drummond 10* (G). HIGHLANDS CO.: *T. G. Harbison 49* (AA); *J. B. McFarlin 8433* (AA, US). INDIAN RIVER CO.: *Ed. Palmer 51* (Ch, Mo, US); *J. K. Small 8896* (NY). LAKE CO.: *A. H. Hitchcock s. n.* (Ch, Mo, NY); *G. V. Nash 2089* (Ch, G, Mo, US); *H. J. Webber 451* (Mo). MANATEE CO.: *J. H. Simpson 50* (Ch, US). MARION CO.: *C. D. Mell 125* (Ch). SARASOTA CO.: *C. H. M. Barrett 23* (US). OKEECHOBEE CO.: *J. K. Small, N. L. Britton, E. G. Britton & J. B. De Winkeler 9249* (US). POLK CO.: *P. O. Schallert s. n.* (G, Mo). PUTNAM CO.: *G. B. Sudworth s. n.* (US). VOLUSIA CO.: *S. C. Hood s. n.* (G, Mo). PRECISE LOCALITY LACKING: *S. B. Buckley s. n.* (Mo, NY); *A. W. Chapman s. n.* (NY); *H. Cooper s. n.* (NY); *A. H. Howell 1142* (US); *C. Mohr s. n.* (NY, US).

ALABAMA: BALDWIN CO.: *J. G. Jack 3070* (AA). MOBILE CO.: *C. Mohr s. n.* (US).

This species, the sole American representative of a somewhat sizable genus which otherwise inhabits the Asiatic tropics, is very well known in both wild and cultivated states. It can be separated easily from all other American species of the family by its coriaceous persistent leaves and the rather long-oblong winged seeds from woody capsules.

In distribution it appears to be confined to the coastal plain areas extending from North Carolina south through South Carolina, Georgia, Florida, and briefly into the southern part of Alabama.

2. FRANKLINIA Marshall

Franklinia Marshall, Arbust. Amer. 48. 1785. — J. F. Gmelin, Syst. Nat. ed. 13, **2**: 810. 1791. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 134. 1925.

Michauxia Salisbury, Prodr. Stirp. Chap. Allert. 386. 1796. Non L'Heritier 1788, nec Necker 1791.

Lacathea Salisbury in W. Hooker, Paradis. Londin. *t. 56*. 1806.

TYPE SPECIES: *Franklinia alatamaha* Marshall.

Flowers hermaphroditic. Sepals 5, imbricate, deciduous, suborbicular, coriaceous, unequal. Petals 5, membranaceous, obovate, crenulate. Stamens numerous; filaments free, adnate to the base of the corolla. Ovary rounded, truncate at the apex, conspicuously ridged, 5-celled; styles connate, slender, deciduous; stigma 5-lobed. Capsule subglobose, woody, 5-valved, dehiscing loculicidally from above, septicidally below with a persistent central axis. Seeds 6–8 in each cell, closely packed, wingless.

Shrubs or small trees with alternate, remotely serrulate deciduous leaves. Flowers large and showy, subsessile, axillary, solitary, with two quickly caducous bracts below the calyx.

Franklinia alatamaha Marshall, Arbust. Amer. 49. 1785. — Bartram, Trav. **16**, 467. 1791. — Small, Fl. SE U. S. 793. 1903; ed. 2, 1913; Man. SE Fl. 876, *fig.* 1933. — Britton & Shafer, N. Amer. Trees 704, *fig. 649*. 1908. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 135. 1925. — Wherry in Jour. Washington Acad. Sci. **18**: 172–176. 1928. — Harper & Leeds in Bartonia **19**: 1–13, *fig.* 1937. — Rehder, Man. Cult. Trees & Shrubs ed. 2, 636. 1940; Bibl. Cult. Trees & Shrubs 461. 1949. — Bailey, Man. Cult. Pl. ed. 2, 673. 1949.

Gordonia pubescens Cavanilles, Diss. Bot. **5**: 308, *t. 162*. 1787. — Lamarck, Encycl. Meth. Bot. **2**: 770. 1788. — L'Heritier, Stirp. Nov. 156. 1791. — Michaux, Fl. Amer.-Bor. **2**: 42. 1803; ed. 2, **2**: 42. 1820. — Ventenat, Jard. Malmaison *t. 1*. 1803. — Duhamel, Arb. & Arbust. ed. 2, **2**: 237. 1804. — Desfontaines, Hist. Arb. **1**: 484. 1809. — Dumond-Courset, Bot. Cult. ed. 2, **5**: 107. 1811. — Michaux f., Hist. Arb. For. Amér. Sept. **3**: 135, *t. 2*. 1813. — Pursh, Fl. Amer. Sept. **1**: 451. 1814. — Michaux, N. Amer. Sylva **2**: 140, *t. 59*. 1818. — Mordant de Launay, Herb. Gén. Amateur, sér. 1, **4**: *t. 236*. 1820. — Elliot, Sketches Bot. **2**: 171. 1822. — De Candolle, Prodr. **1**: 528. 1824. — Drapiez, Herb. Amateur Fl. **3**: *t. 573 [265]*. 1829. — G. Don. Gen. Syst. **1**: 573. 1831. — J. C. Loudon, Arb. & Fruct. Brit. **1**: 381. *fig. 94*. 1838. — Torrey & Gray, Fl. N. Amer. **1**: 223. 1838. — Gray, Gen. Ill. **2**: 102, *t. 141, 142*. 1849. — Darby, Bot. S. States 257. 1855. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14**: 139 (Mém. Ternstr. 51). 1855. — Chapman, Fl. South. U. S. ed. 1, 60. 1860. — Loudon, Trees & Shrubs 73, *fig. 111*. 1875. — Goodale & Sprague, Wild Fl. Amer. 193, *t. 47*. 1882. — Sargent, Forest Trees N. Amer. 10th Census **9**: 25. 1884. — Szyszylowicz in Nat. Pflanzenfam. III. **6**: 185. 1893. — Gray, Syn. Fl. N. Amer. **1**: 293. 1897. — Rehder in Möller's Deutsche Gärtn.-Zeit. **14**: 25. 1899. — Keeler, Our North. Shrubs 33, *t.* 1903; ed. 2, 1912. — Apgar, Orn. Shrubs U. S. 80, *fig. 53*. 1910. —

Bean, Trees & Shrubs Hardy Brit. Isles **1:** 597. 1914; ed. 3, 1921. — Mathews, Field Book Amer. Trees & Shrubs 329, *fig.* 1915.

Gordonia Franklini L'Heritier, Stirp. Nov. 156. 1791. — Willdenow, Spec. Pl. **3:** 841. 1800. — Duhamel, Arb. & Arbust. ed. 2, **2:** 237. 1804. — Desfontaines, Hist. Arb. **1:** 484. 1809. — Eaton, Man. Bot. ed. 1, 78. 1817, as *"G. franklinia."*

Franklinia americana J. F. Gmelin, Syst. Nat. ed. 13, **2:** 810. 1791.

Michauxia sessilis Salisbury, Prodr. Stirp. Chap. Allert. 386. 1796.

Lacathea florida Salisbury in W. Hooker, Paradis. Londin. **1:** *t. 56.* [1806]. — Colla, Hort. Repul. (Append. i) 134. 1824.

Gordonia pubescens Cavanilles *α velutina* De Candolle, Prodr. **1:** 528. 1824. — G. Don, Gen. Syst. **1:** 573. 1831.

Gordonia pubescens Cavanilles *β subglabra* De Candolle, Prodr. **1:** 528. 1824. — G. Don, Gen. Syst. **1:** 573. 1831.

Franklinia alatama Rafinesque in First Cat. Bot. Gard. Transylv. Univ. 21. 1824, *nom.*; Atlantic Jour. **1:** 79, *fig.* 1832.

Gordonia Altamaha (Marshall) Sargent in Gard. & For. **2:** 616. 1889; Silva N. Amer. **1:** 45, *t. 22.* 1891. — Dippel, Handb. Laubholzk. **3:** 31, *fig. 19.* 1893. — Lounsberry, South. Wild Fl. & Trees 338, *t. 108.* 1901. — Sargent, Man. Trees N. Amer. 679, *fig. 554.* 1905. — Schneider, Ill. Handb. Laubholzk. 329, *fig. 219.* 1909. — Silva Tarouca, Freil.-Laubgeh. 229. 1913. — Rehder in Bailey, Stand. Cyclop. Hort. **3:** 1361. 1915; Man. Cult. Trees & Shrubs 636. 1927. — Bailey, Man. Cult. Pl. 501. 1924.

Lasianthus pubescens (L'Heritier) O. Kuntze, Rev. Gen. Pl. **1:** 63. 1891.

Tree 5–7 m. high, the bark thin, smooth, dark brown; branches glabrous, stout, slightly angled, dark reddish brown. Leaves membranaceous, obovate to oblong-obovate, 12–18 cm. long, 5–7 cm. wide, occasionally up to 25 × 9.5 cm.; acute at the apex, long-tapering at the base, when young the under surface densely covered with a light grayish mixed pubescence of long hairs and matted short tufted or stellate hairs, at maturity glabrescent with only occasional hairs of each type, bright green above, paler beneath, the midrib canaliculate above, elevated beneath, the veins 10–12 pairs, conspicuous on both surfaces, the margin remotely serrate, usually to below the middle, occasionally nearly to the base. Flowers solitary, axillary in the axes of crowded upper leaves, appearing in late September (Boston); pedicel very short, stout, terete, densely pubescent at first, glabrescent; bracteoles 2, quickly caducous; calyx-lobes 5, imbricate, deciduous, suborbicular, 1–1.5 cm. long, ciliate at the margins, densely covered with appressed-tufted hairs on the exterior surface; petals 5, white, membranaceous, obovate, large, up to 6 cm. long, 4 cm. wide, usually smaller, crenulate along the margin, densely pubescent on the exterior surface, the outer petal usually smaller and more incurved; stamens numerous, the filaments free, adnate to the base of the corolla, 1–1.5 cm. long; ovary rounded, densely pubescent, conspicuously ridged, truncate or nearly so at the apex, 5-celled, the style slender, as long as the stamens, deciduous, the stigma 5-lobed. Capsule globose, woody, 5-celled, splitting loculicidally from the apex to the middle and septicidally from the base to the middle,

giving a rick-rack appearance, maintaining contact after dehiscence at the center with the deeply grooved central axis. Seeds 6–8, closely packed, ca. 1 cm. long, wingless.

SPECIMENS EXAMINED:

CULTIVATED ONLY:

MASSACHUSETTS: ARNOLD ARBORETUM: *C. E. Faxon* (AA, G); *J. G. Jack* (AA); *C. E. Kobuski* (AA); *C. E. Kobuski & E. F. Roush* (AA); *E. J. Palmer* (AA); *A. Rehder* (Mo); *W. A. Setchell* (Mo).

PENNSYLVANIA: Hort. Bartram Gard., Philadelphia, *C. E. Smith* (US); Collector unknown (Mo). Hort. T. Meehan, Philadelphia, *C. E. Faxon* (G); Collector unknown (AA). Hort. Laurel Hill, Philadelphia, *Miss Morris* (G). Hort. John Evans Garden, Delaware Co., *T. C. Porter* (Ch).

MARYLAND: Hort. Chevy Chase, *F. V. Coville* (US); *P. L. Ricker* (Mo).

WASHINGTON, D. C.: Hort. Saul's Nursery (1881–1882) *L. F. Ward* (US); *G. Vasey* (US); Hort. Congressional Garden, *C. C. Parry* (US); Hort. Lafayette Sq., *A. Schott* (Ch); *G. B. Sudworth* (US). Precise locality lacking, *G. B. Sudworth* (AA); *G. Vasey* (Mo, US).

MISSOURI: Hort. Shaw's Garden, *G. Engelmann* (Mo); "St. Louis," *E. E. Sherff* (Ch).

FRANCE: Hort. Les Barres (French Nat. Arb.), Nancy, *C. K. Schneider* (AA).

Except perhaps for the genus *Camellia*, it appears that more research and study have been devoted to this single species than to any other member of the family. Why? Certainly not for its beauty! It is an attractive tree, true enough, with an interesting late period of flowering, but no more attractive nor hardy than the other species of this family found in our gardens.

Its history is interesting to a degree! It seems that the species was first observed by John Bartram in 1765 growing wild in Georgia on some sandhills along the northeast side of the Altamaha River, within four miles (downstream) of Fort Barrington in what is now known as McIntosh County. Eight years later (1773), William Bartram, the son of John Bartram, revisited the locality and collected ripe seeds from which were grown several plants which flowered in four years. Exactly twenty years after the original discovery the species was described by Humphrey Marshall, a cousin of John Bartram. It is to the plants of William Bartram that all the known specimens of the "Franklin tree" in cultivation today in this country owe their origin.

According to Harper and Leeds (Bartonia **19**: 1–13, *fig.* 1937), Moses Marshall, a nephew of Humphrey Marshall, was the last known collector to find *Franklinia* in the wild state. This was in 1790. These authors suggest that the attempt to fill large orders of *Franklinia* for a London firm, in 1787 and 1789, by the nursery concern of Humphrey and Moses Marshall may have been the cause of the apparent extermination of the species. There is little doubt that this wholesale collection of a species so closely confined geographically would contribute greatly to its extinction.

It was nearly a hundred years later, in 1880 and 1881, that H. W. Ravenel, at the suggestion of C. S. Sargent, Director of the Arnold Arboretum, made five trips to the type locality of the species. These were followed by other searches, but none of them resulted in the collection of the species. Frequent rumors or reports of its re-discovery have been announced, but usually the discovery turns out to be a collection of *Gordonia Lasianthus* or one of the *Stewartiae*, all close relatives of the species in question.

TEXT-FIGURE II. Original geographical location of *Franklinia alatamaha* Marshall.

Very interesting reading indeed are the two quite recent articles on the history of the genus published by E. T. Wherry (Jour. Washington Acad. Sci. 18: 172–176. 1928) and F. Harper & A. N. Leeds (Bartonia 19: 1–13, *fig.* 1937). It is from these two papers that this present, very condensed account has been gathered.

For many years the species had been known as *Gordonia pubescens*, and later as *Gordonia "altamaha."* Few authors up to 1925 recorded it technically under *Franklinia*. In that year Melchior in his treatment of the family (Nat. Pflanzenfam. ed. 2, **21**: 135. 1925) recognized anew the genus as distinct from *Gordonia*. Since then both Rehder and Bailey have changed their concepts and have accepted the separation.

In its unusual manner of dehiscence the fruit of the Franklin tree is quite distinct from that of all other members of the family known to me. At the apex the capsule splits loculicidally to the center, while from the base it splits septicidally. The leaves are deciduous and membranaceous. All members of the genus *Gordonia* are coriaceous.

In this country the species is cultivated as far north as Massachusetts. Records show that it is valued equally in the gardens of England, France, and Germany.

3. STEWARTIA Linnaeus

Stewartia Linnaeus, Sp. Pl. 698. 1753; Gen. Pl. ed. 5, 311, no. 758. 1754. — Szyszylowicz in Nat. Pflanzenfam. III. 6: 186. 1893.

Malachodendron Cavanilles, Monadelph. Diss. **5:** 302. 1788.

Stuartia L'Heritier, Stirp. Nov. 153. 1791. — Bentham & Hooker f., Gen. Pl. **1:** 185. 1862.

Cavanilla Salisbury, Prodr. Stirp. Chap. Allert. 385. 1796. Non J. F. Gmelin 1791, nec Thunberg 1795.

TYPE SPECIES: *Stewartia Malachodendron* L.

Flowers hermaphroditic. Sepals 5, imbricate, somewhat unequal, persistent. Petals 5, rarely 6–8, obovate to rounded, crenulate, connate at the base, silky pubescent on the external surface. Stamens numerous; filaments adnate to the base of the corolla, otherwise free or joined at the base in a ring; anthers introrse, versatile, 2-celled, the oblong cells opening longitudinally. Ovary superior, 5-celled; styles 5, distinct or united into one; stigmas 5 or united into a single 5-crenate compound stigma. Capsule woody, 5-celled, loculicidally dehiscent, with or without a persistent columella. Seeds compressed, one to four in each cell, obovate-lenticular, the testa thick and crustaceous, with or without a wing-like margin.

Shrubs or trees with membranaceous and alternate, usually serrulate leaves. Flowers large and showy, axillary, solitary, with one or two bracts below the calyx.

Two very distinct species represent this genus in the United States. Easily distinguished by the style and fruit, they can also be quite accurately distinguished by their geographical distribution.

Stewartia ovata, as the accompanying map testifies, prefers the eastern slopes of the Allegheny Mountain range and exhibits its greatest concentration (judged on the basis of herbarium collections) in south-central Tennessee, northern Alabama and Georgia, and is found less abundantly in South and North Carolina. *Stewartia Malachodendron* appears to have been collected less frequently and from scattered localities. The pattern of its distribution follows more closely the coastal range, extending from Virginia through all the coastal states to Louisiana. In only two counties, Cullman Co. in Alabama and Macon Co. in North Carolina, are both species represented by the herbarium material studied here. An interesting note regarding distribution is the fact that this species has been thrice collected in Ouachita Co. in Arkansas.

KEY TO THE SPECIES

A. Styles 5, distinct; seeds reddish brown, dull, not angled, with a narrow membranaceous margin.....*Stewartia ovata.*

AA. Styles united, with 5 stigmas; seeds lustrous, angled, lacking an evident margin.....*Stewartia Malachodendron.*

Stewartia ovata (Cavanilles) Weatherby in Rhodora **41**: 193. 1939. — Rehder, Man. Cult. Trees & Shrubs ed. 2, 635. 1940; Bibl. Cult. Trees & Shrubs 461. 1949. — Bailey, Man. Cult. Pl. ed. 2, 673. 1949.

Malachodendron ovatum Cavanilles, Diss. Bot. **5**: 302, *t. 158, fig. 2*. 1787. — Michaux, Fl. Amer.-Bor. **2**: 43. 1803; ed. 2, 43. 1820. — De Candolle, Prodr. **1**: 528. 1824. — Lindley in Edwards, Bot. Reg. **13**: *t. 1104*. 1827. — Loudon, Trees & Shrubs 71. 1875.

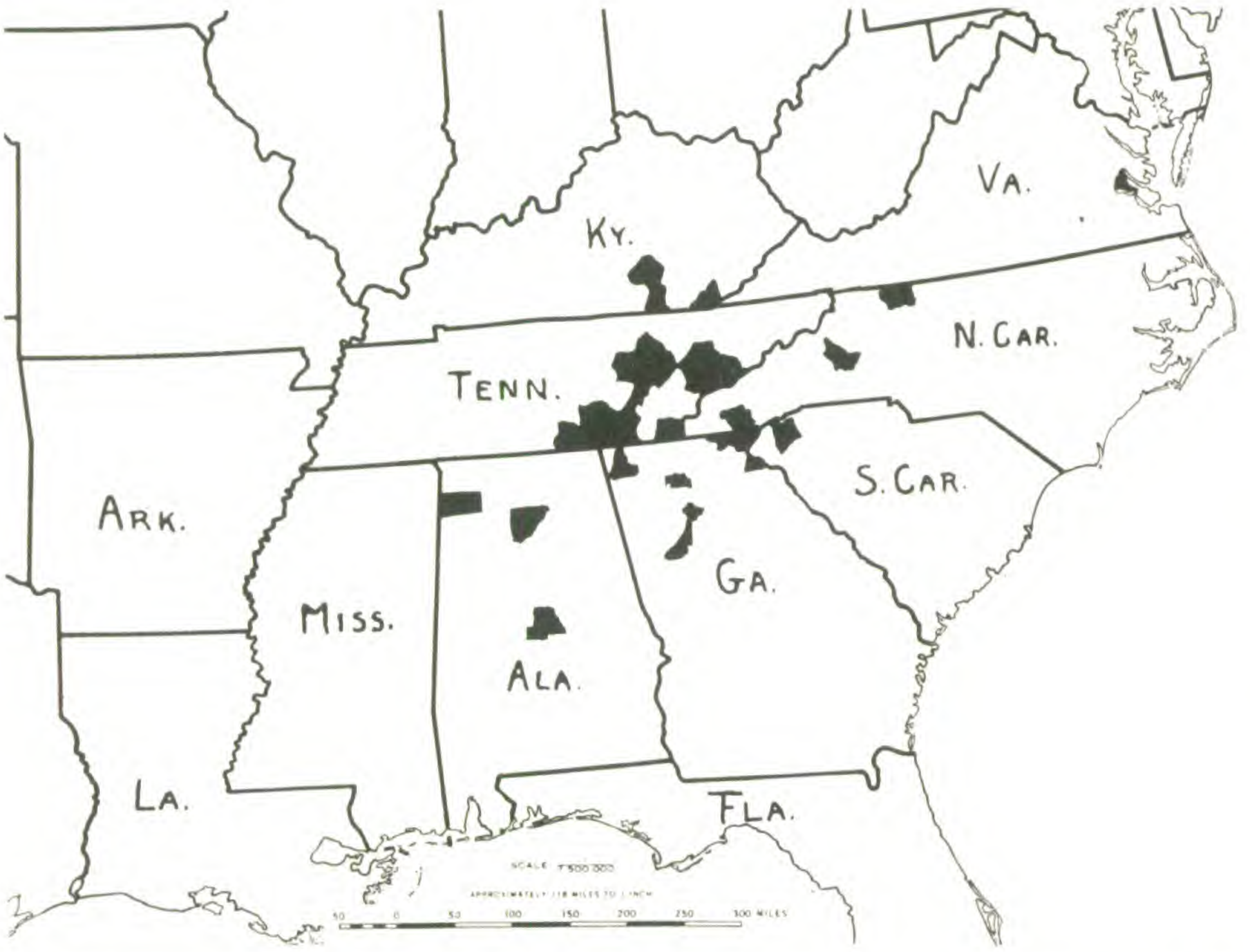
Stewartia pentagyna L'Heritier, Stirp. Nov. 155, *t. 74*. 1791. — Willdenow, Spec. Pl. **3**: 840. 1800. — J. E. Smith, Exot. Bot. **2**: 101, *t. 110*. 1805. — Desfontaines, Hist. Arb. **1**: 482. 1809. — Pursh, Fl. Amer. Sept. **1**: 452. 1814. — Nuttall, Gen. N. Amer. Pl. **2**: 84. 1818. — Elliot, Sketches Bot. **2**: 173. 1822. — Torrey & Gray, Fl. N. Amer. **1**: 224. 1838. — Hooker in Curtis's Bot. Mag. **68**: *t. 3918*. 1842. — Lemaire in Herb. Gen. Amateur, sér. 2, **3**: *t. 48*. 1845. — Gray, Gen. Ill. **2**: 100, *t. 139*. 1849. — Darby, Bot. S. States 257. 1855. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14**: 137 (Mém. Ternstr. 49). 1855. — Chapman, Fl. South. U. S. ed. 1, 61. 1860. — Curtis, Geol. & Nat. Hist. Surv. N. Carol. **3**: 14. 1867. — Watson & Coulter in Gray's Man. Bot. North. U. S. ed. 6, 96. 1890. — Nicholson in Gard. **43**: 173. 1893. — Szyszylowicz in Nat. Pflanzenfam. III. **6**: 186. 1893. — Dippel, Handb. Laubholzk. **3**: 30, *fig. 18*. 1893. — Koehne, Deutsche Dendrol. 414, *fig. 60, d & e*. 1893. — Gray, Syn. Fl. N. Amer. **1**: 292. 1897. — Lounsberry, South. Wild Fl. & Trees 337. 1901. — Keeler, Our North. Shrubs 31, *t.* 1903; ed. 2, 1912. — B. in Fl. & Sylva **3**: 264. 1905. — Robinson & Fernald in Gray's Man. Bot. ed. 7, 570. 1908. — Schneider, Ill. Handb. Laubholzk. 330, *fig. 220, a-c*. 1909. — Apgar, Orn. Shrubs U. S. 80, *fig. 50*. 1910. — Silva Tarouca, Freil.-Laubgeh. 358. 1913. — Bean, Trees & Shrubs Hardy Brit. Isles **2**: 553. 1914; ed. 3, 1921. — Mathews, Field Book Amer. Trees & Shrubs 326, *fig.* 1915. — Rehder in Bailey, Stand. Cyclop. Hort. **6**: 3241. 1915. — Bailey, Man. Cult. Pl. 501. 1924. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 134. 1925. — Rehder, Man. Cult. Trees & Shrubs 625. 1927.

Stewartia montana Bartram, Travels 334. 1791; ed. 2, 332. 1792. — Merrill in Bartonia **23**: 32. 1945.

Malachodendron pentagynum (L'Heritier) Dumond-Courset, Bot. Cult. ed. 2, **5**: 107. 1811. — Small, Fl. SE U. S. 793. 1903; ed. 2, 1913; Man. SE Fl. 876, *fig.* 1933.

Shrub up to 5 m. high; branchlets terete, gray, reddish in the new growth, quite glabrous even when very young. Leaves deciduous, membranaceous, elliptic to oblong-ovate, 8–12 cm. long, 4–6 cm. wide, rarely as large as 15 × 7 cm., acuminate at the apex, broadly cuneate to rounded at the base, dark green (often tinged with red) and glabrous above, light grayish green and sparingly pubescent beneath, the margin ciliate and remotely serrulate, the veins 5–7 pairs, dark and conspicuous on the under surface, the petiole varying in length, 3–15 mm. long, sparingly pubescent, expanding toward the base. Flowers axillary, solitary; pedicel terete, pubescent, ca. 5 mm. long; bracteoles foliaceous, oblong-ovate, 10–12 mm. long, 5 mm. wide, pubescent, ciliate along the margin; calyx-lobes 5, imbricate, foliaceous, oblong-ovate, up to 20 mm. long, 8 mm. wide, pubescent on

the exterior surface, occasionally sparingly so on the interior surface, ciliate along the margin; petals 5 (occasionally 6), white, obovate, unequal, 2.5–4 cm. long, 2–3 cm. wide, crenulate along the margin; stamens numerous, the filaments glabrous, 18–20 mm. long, yellow, quite free to the base, adnate to the base of the corolla, the anthers orange; ovary globose, densely white-pubescent, ca. 4–5 mm. diam., 5-celled, the styles 5, conspicuous, as long as the stamens, occasionally exceeding them. Capsule ovoid, subligneous, sharply angled, apiculate, pubescent, 5-celled. Seeds reddish brown, dull, ca. 7 mm. long, not angled, with a narrowly winged margin.



TEXT-FIGURE III. Geographical distribution of *Stewartia ovata* (Cavanilles) Weatherby by counties, based on the herbarium specimens studied.

SPECIMENS EXAMINED:

VIRGINIA: JAMES CITY CO.: *L. Artz 432* (US), *s. n.* (US); *E. J. Grimes 3818* (G, NY); *E. T. Wherry & F. W. Pennell 12542* (Mo).

KENTUCKY: BELL CO.: *T. H. Kearney 322* (AA, Ch, G, Mo, US), *545* (Ch, NY), *s. n.* (Ch); *E. Lucy Braun 1580* (AA). MCCREARY CO.: *F. T. McFarland 4375* (Mo); *E. L. Braun s. n.* (G, NY). PULASKI CO.: *J. D. Smith s. n.* (G, US).

TENNESSEE: BLOUNT CO.: *A. Moore s. n.* (US); *A. Ruth 376* (NY), *391* (Mo), *1205* (NY), *2624* (Mo, NY), *s. n.* (Ch, G, Mo, NY, US). CUMBERLAND CO.: *D. M. Coffman 344* (US); *A. Gattinger 408* (AA, Ch, G, Mo, NY, US), *s. n.* (AA, Ch, Mo, NY, US). HAMILTON CO.: *A. H. Curtis s. n.* (US). GRUNDY CO.: *H. K. Svenson 7306* (G). KNOX CO.:

H. M. Jennison s. n. (G). MARION CO.: *H. K. Svenson 8913* (G). MORGAN CO.: *A. S. Percival s. n.* (Ch). POLK CO.: *Biltmore Herb. 886*[c] (AA, G, NY, US); *A. Gattinger s. n.* (G). RHEA CO.: *Biltmore Herb. 886*[h] (NY, US); *D. M. Coffmann s. n.* (AA, US). ROANE CO.: *D. White s. n.* (Mo, US). SEQUATCHIE CO.: *J. H. H. Boyd s. n.* (AA). SEVIER CO.: *L. Barksdale s. n.* (NY); *W. H. Camp 1744* (NY); *H. M. Jennison & J. C. Smith 968* (Ch, G, Mo, NY, US); *C. S. Sargent s. n.* (AA); *J. K. Underwood, L. R. Hassler & A. J. Sharp* (Mo). PRECISE LOCALITY LACKING: *T. F. Allen s. n.* (NY); *A. Gattinger s. n.* (AA, NY, US); *F. Lamson-Scribner s. n.* (NY); *S. Price s. n.* (Mo); *F. Rugel s. n.* (NY); *G. B. Sudworth s. n.* (US).

NORTH CAROLINA: BURKE CO.: (*M.*) *G. McCarthy s. n.* (NY). MACON CO.: *Biltmore Herb. 886* (Ch, Mo, NY, US), *886*[b] (AA, Ch, G, Mo, NY, US); *C. L. Boynton s. n.* (Mo); *T. G. Harbison s. n.* (G); *L. Stewart s. n.* (NY); *E. H. White s. n.* (NY). SURRY CO.: Biltmore Herb. *886*[g] (NY, US). PRECISE LOCALITY LACKING: *J. Carey s. n.* (NY); *C. S. Sargent s. n.* (AA).

SOUTH CAROLINA: PRECISE LOCALITY LACKING: *F. E. Boyton s. n.* (US).

GEORGIA: FULTON CO.: *E. T. Wherry s. n.* (AA). PICKENS CO.: *Biltmore* Herb. *886*[f] (US). RABUN CO.: *E. J. Alexander, T. H. Everett & S. D. Pearson s. n.* (NY); *T. G. Harbison 52* (AA); *J. H. Pyron & R. McVaugh 806* (US); *D. Samson s. n.* (NY); *J. K. Small s. n.* (AA, Ch, G, Mo, NY, US). STEPHENS CO.: *T. G. Harbison 10* (AA). TOWNS CO.: *C. S. Sargent s. n.* (AA). WALKER CO.: *J. D. Smith s. n.* (US). WHITE CO.: *W. W. Ashe s. n.* (Mo). PRECISE LOCALITY LACKING: *S. B. Buckley s. n.* (G, Mo); *C. Wright s. n.* (G).

ALABAMA: CHILTON CO.: Biltmore Herb. *886*[e] (US); *T. G. Harbison s. n.* (AA). FRANKLIN CO.: *R. M. Harper 3398* (AA, G, Mo, US); *L. James 29* (Mo). CULLMAN CO.: *H. Eggert s. n.* (Mo, NY, US); *C. Mohr* (US); *G. B. Sudworth s. n.* (US); *W. Wolf s. n.* (Ch, G, US). PRECISE LOCALITY LACKING: *S. B. Buckley s. n.* (NY).

Stewartia ovata (Cavanilles) Weatherby var. **grandiflora** (Bean) Weatherby in Rhodora **41:** 193. 1939. — Rehder, Man. Cult. Trees & Shrubs ed. 2, 635. 1940; Bibl. Cult. Trees & Shrubs 461. 1949. — Bailey, Man. Cult. Pl. ed. 2, 673. 1949.

Stewartia pentagyna L'Heritier var. *grandiflora* Bean, Trees & Shrubs Hardy Brit. Isles **2:** 555. 1914; ed. 3, 1921. — Rehder in Bailey, Stand. Cyclop. Hort. **6:** 3241. 1915; Man. Cult. Trees & Shrubs 625. 1927.

Malachodendron pentagynum (L'Heritier) Dumond-Courset var. *grandiflorum* (Bean) Alexander in Brittonia **19:** 1, *t. 609*. 1935.

In separating this variety, W. J. Bean signified that the flowers were larger than those of the species and that the stamens were purple. Actually the size of the flower varies very little between the species and the variety, especially in the wild. The filaments of the variety are purple, while those of the species are yellow. In both, the anthers are yellow.

No specimens of this variety have been cited in this study. Most specimens, when dried, present a distinct golden color in the filaments, in no way to be interpreted as purple. However, some of the poorer specimens

show the filaments dark in color — in most instances due to poor drying.

L. Artz 432 in the U. S. National Herbarium bears the only record of the finding of this variety in the wild. Miss Artz, whose specimen was collected near Williamsburg, Virginia, states: "Two forms. The plant with dark red color in leaves bears purple-stamened blossoms, the other, yellow-stamened blossoms." Miss Artz's specimen, however, is in fruit. A very fine color illustration may be found in Addisonia **19**: 1, *pl. 609*. 1935.

Stewartia Malachodendron Linnaeus, Spec. Pl. 698. 1753; ed. 2, 982. 1762. — Buc'hoz [Buchoz], Pl. Nouv. Découv. 18, *t. 16*. 1779 — Walter, Fl. Carol. 175. 1788. — L'Heritier, Stirp. Nov. 153, *t. 73*. 1791. — Willdenow, Spec. Pl. **3**: 840. 1800. — Desfontaines, Hist. Arb. **1**: 482. 1809. — Torrey & Gray, Fl. N. Amer. **1**: 224. 1838. — Carrière in Rev. Hort. **1878**: 70, *t.* 1878. — Szyszylowicz in Nat. Pflanzenfam. III. **6**: 186, *fig. 94*. 1893. — Gray, Syn. Fl. N. Amer. **1**: 292. 1897. — Lounsberry, South. Wild Fl. & Trees 338. 1901. — Small, Fl. SE U. S. 793. 1903; ed. 2, 1913. — Hemsley in Curtis's Bot. Mag. **133**: *t. 8145*. 1907. — Anon. in Gard. Chron., ser. 3, **42**: 32, *fig. p. 27*. 1907; **44**: 132, *fig. 52*. 1908. — Robinson & Fernald in Gray's Man. Bot. ed. 7, 570. 1908. — Apgar, Orn. Shrubs U. S. 80. 1910. — Bean, Trees & Shrubs Hardy Brit. Isles 553, *fig.* 1914; ed. 3, 1921. — Mathews, Field Book Amer. Trees & Shrubs 326, *fig.* 1915. — Rehder in Bailey, Stand. Cyclop. Hort. **6**: 3241. 1915. — Bailey, Man. Cult. Pl. 501. 1924; ed. 2, 674. 1949. — Melchior in Nat. Pflanzenfam. ed. 2, **21**: 134, *fig. 62*. 1925. — Rehder, Man. Cult. Trees & Shrubs 624. 1927; ed. 2, 634. 1940; Bibl. Cult. Trees & Shrubs 461. 1949. — Small, Man. SE Fl. 876, *fig.* 1933. — Fernald in Gray's Man. Bot. ed. 8, 1007. 1950.

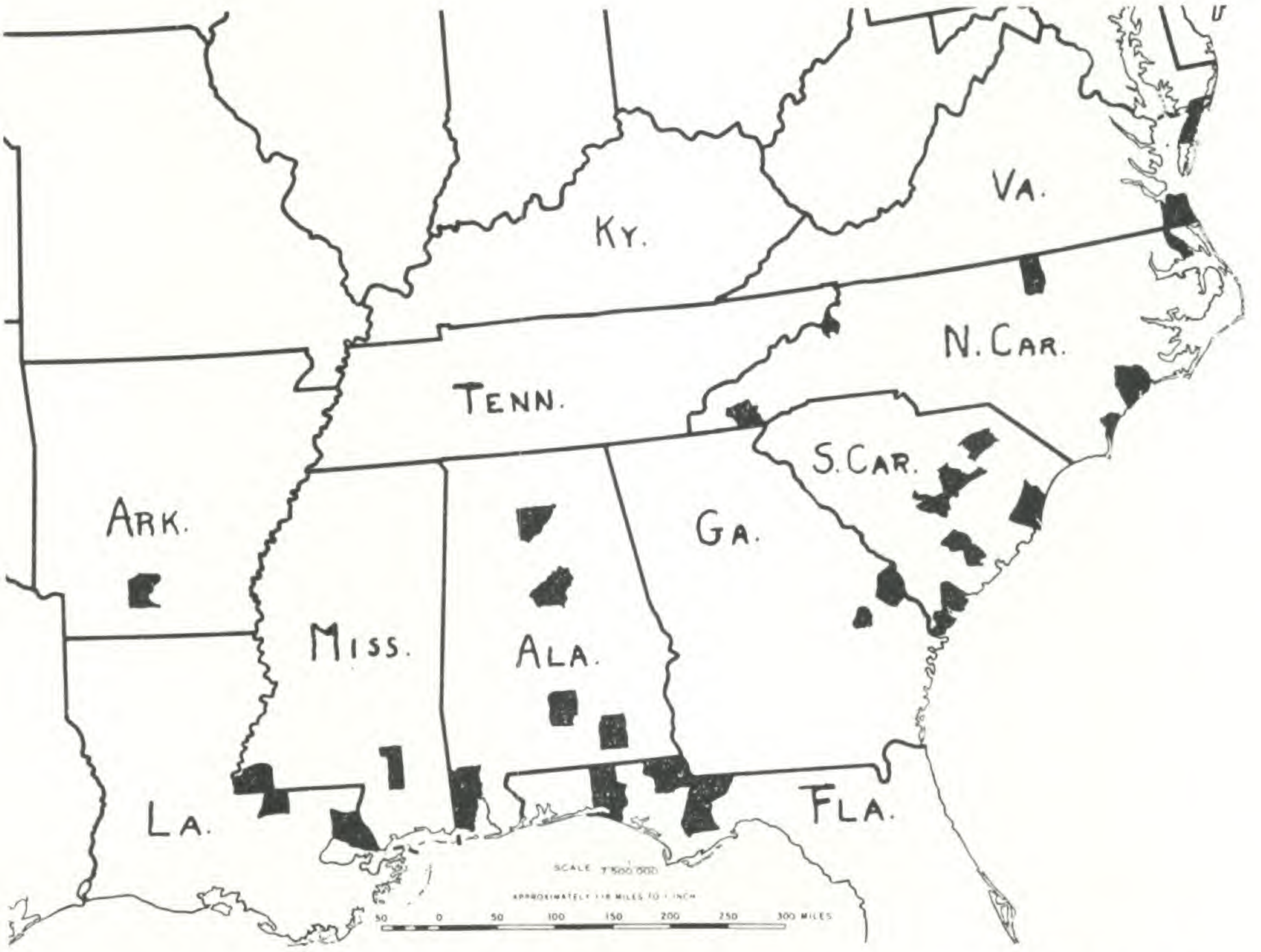
Stewartia virginica Cavanilles, Diss. Bot. **5**: 303, *t. 159, fig. 2*. 1787. — Lamarck, Ill. **3**: *t. 594*. 1797. — Michaux, Fl. Amer.-Bor. **2**: 42. 1803; ed. 2, **2**: 42. 1820. — Lamarck, Encycl. Meth. Bot. **7**: 441. 1806. — Pursh, Fl. Amer. Sept. **1**: 451. 1814. — Nuttall, Gen. N. Amer. Pl. **2**: 84. 1818. — Elliot, Sketches Bot. **2**: 172. 1822. — De Candolle, Prodr. **1**: 528. 1824. — G. Don, Gen. Syst. **1**: 573. 1831. — J. C. Loudon, Arb. & Fruct. Brit. **1**: 378, *fig. 92*. 1838. — Gray, Gen. Ill. **2**: 99, *t. 138*. 1849. — Darby, Bot. S. States 257. 1855. — Choisy in Mém. Soc. Phys. Hist. Nat. Genève **14**: 136 (Mém. Ternstr. 48). 1855. — Chapman, Fl. South. U. S. ed. 1, 61. 1860. — Curtis, Geol. & Nat. Hist. Surv. N. Carol. **3**: 14. 1867. — Loudon, Trees & Shrubs 72, *fig. 108, 109*. 1875. — Anon. in Gard. Chron. n. ser. **8**: 443. 1877. — Anon. in Gard. **12**: 595, *fig.* 1877. — Hemsley in Gard. **14**: 38, *t.* 1878. — W. G. in Gard. **18**: 628, *fig.* 1880. — T. in Gard. **26**: 143, *fig.* 1884. — Goldring in Gard. **34**: 280. 1888. — Watson & Coulter in Gray's Man. Bot. North. U. S. ed. 6, 96. 1890. — Dippel, Handb. Laubholzk. **3**: 27, *fig. 15*. 1893. — Anon. in Fl. & Sylva **1**: 73. 1903. — B. in Fl. & Sylva **3**: 265, *fig.* 1905.

Cavanilla florida Salisbury, Prodr. Stirp. Chap. Allert. 385. 1796.

Stuartia nobilis Salisbury, Prodr. Stirp. Chap. Allert. 386. 1796.

Malachodendron monogynum Dumond-Courset, Bot. Cult. ed. 2, **5**: 106. 1811.

Shrub or tree-like shrub up to 7 m. high, the branchlets terete, slender, gray, pubescent when very young. Leaves deciduous, membranaceous, elliptic to oblong-elliptic, 7–11 cm. long, 3–5 cm. wide, acute or shortly acuminate at the apex, cuneate at the base, tapering into a short pubescent petiole ca. 0.5 cm. long, dark green and glabrous above, light green and pubescent beneath, the margin ciliate and serrulate, each serrulation with



TEXT-FIGURE IV. Geographical distribution of *Stewartia Malachodendron* Linnaeus by counties, based on the herbarium specimens studied.

a minute tooth, the veins 7–8 pairs, elevated and conspicuous on the under surface, lightly depressed on the upper surface. Flowers solitary, axillary, usually near the end of the branchlet, large, as much as 10 cm. across; pedicel short, stout, 5 mm. or less long, pubescent; bracteoles 2, ovate, opposite, immediately below calyx, pubescent; calyx-lobes 5, imbricate, unequal, ovate, acute-tipped, ca. 1 cm. or less long, pubescent, ciliate along the margin; petals 5, obovate, white or yellow, silky on the exterior surface, 3–4.5 cm. long, 2.5–3 cm. wide, crenulate along the margin; stamens numerous, the filaments joined at the base in a ring, otherwise free, unequal, 8–10 mm. long, the anthers bluish in color; ovary ovoid, ca. 5 mm. diam., densely pubescent, 5-celled, styles united appearing as one, glabrous, the stigma 5-lobed. Capsule woody, loculicidally dehiscent into 5 valves, quite globose, occasionally conical at the apex, pubescent; seeds dark, lustrous, ca. 7 mm. long, ca. 4 mm. wide, three-sided, wingless.

SPECIMENS EXAMINED:

VIRGINIA: ACCOMAC CO.: *E. Mears s. n.* (G, NY). NORFOLK CO.: *M. L. Fernald & B. Long 11078* (G), *12131* (G); *M. L. Fernald & L. Griscom 4455* (AA, G). PRINCESS ANNE CO.: *M. L. Fernald & B. Long 10726* (Ch, G, Mo, US); *M. L. Leigh s. n.* (G); *K. K. MacKenzie s. n.*

NORTH CAROLINA: AVERY CO.: *Kelsey s. n.* (Mo). GRANVILLE CO.: (*M.*) *G. McCarthy s. n.* (US). NEW HANOVER CO.: *S. W. Noble s. n.* (US). ONSLOW CO.: *H. Moldenke 1246a* (Mo, NY). PASQUOTANK CO.: *K. M. Wiegand & W. E. Manning 1977* (G). PRECISE LOCALITY LACKING: *M. A. Curtis s. n.* (Mo); *Loomis s. n.* (NY).

SOUTH CAROLINA: BEAUFORT CO.: *J. H. Mellichamp s. n.* (AA). CALHOUN CO.: *Biltmore Herb. 886*[d] (US). DARLINGTON CO.: *E. J. Palmer 42378* (AA). DORCHESTER CO.: *J. H. Mellichamp s. n.* (AA); *J. B. s. n.* (US). GEORGETOWN CO.: *T. G. Harbison s. n.* (AA). SUMTER CO.: *M. M. Childs s. n.* (US).

GEORGIA: CANDLER CO.: *W. H. & M. B. Duncan 3964* (G, US); *E. T. Wherry s. n.* (G). SCREVEN CO.: *D. Eyles 6936* (G). PRECISE LOCALITY LACKING: *A. Gray s. n.* (NY); *T. G. Harbison 1150* (AA).

FLORIDA: GADSDEN CO.: *A. W. Chapman s. n.* (Mo, NY). JACKSON CO.: *T. G. Harbison 13* (AA). LIBERTY CO.: *E. J. Palmer 38546* (AA, NY, US). WALTON CO.: *E. J. Palmer 38605* (AA, Mo); *J. K. Small, C. A. Mosier & P. A. Mathaus s. n.* (NY). PRECISE LOCALITY LACKING: *W. Baldwin s. n.* (Ch, G, Mo); *A. W. Chapman s. n.* (G).

ALABAMA: BUTLER CO.: *R. M. Harper 98* (G, Mo, NY, US). COFFEE CO.: Biltmore Herb. *4667*[e] (US). CULLMAN CO.: Biltmore Herb. *4667*[d] (US); *C. Mohr s. n.* (US). MOBILE CO.: *C. Mohr s. n.* (Ch). SHELBY CO.: *M. M. Everts 407* (NY). TUSCALOOSA CO.: *E. A. Smith s. n.* (AA). PRECISE LOCALITY LACKING: *C. W. Short s. n.* (NY).

MISSISSIPPI: FORREST CO.: *T. G. Harbison 10* (AA). WILKINSON CO.: *I. S. B. s. n.* (Ch). PRECISE LOCALITY LACKING: *E. Hilgard* in 1858 (Mo), 1859 (Mo) and 1867 (Mo); *C. Koch s. n.* (US).

LOUISIANA: EAST FELICIANA CO.: *S. B. Buckley s. n.* (Mo). ST. TAMMANY CO.: *R. S. Cocks s. n.* (AA). PRECISE LOCALITY LACKING: *W. M. Carpenter s. n.* (Ch, G); *J. Hale s. n.* (G); *S. T. Olney s. n.* (G).

ARKANSAS: OUACHITA CO.: *A. Fendler s. n.*, May 11, 1850, (Mo), May 19, 1850 (G).

ARNOLD ARBORETUM,

HARVARD UNIVERSITY.

SOME NOTEWORTHY MYRTACEAE FROM THE MOLUCCAS, NEW GUINEA, AND THE SOLOMON ISLANDS

C. T. White *

With one plate

The following is an account of some Myrtaceae from the Pacific region submitted to me for determination by the Arnold Arboretum. It supplements a previous paper on "Some Papuan Myrtaceae" in this Journal (23: 80–92, pl. 1. 1942). The collection was small, but it contained a new genus with rather striking characters, and extended the known range of the genera *Eugenia* (*sensu stricto*), *Mearnsia* and *Rhodamnia* to the Solomon Islands.

Eucalyptopsis gen. nov.

Calycis tubus campanulatus supra ovarium leviter constrictus et deinde articulatus irregulariter disruptus et in lobos ad discum staminalem divisus. Petala nulla. Stamina numerosa, in fasciculos 4 disposita, in alabastris pendentia, filamentis rectis inaequalibus connectivi basim versus affixis; antherae loculis parallelis longitudinaliter dehiscentibus. Ovarium planum in fundo calycis inferum vel deinde semisuperum, biloculare; ovulis in loculis ca. 15 sed modo uno maturescente placentae peltatae affixis adscendentibus. Capsula lignosa parte superiore calycis tubo persistenti adnata, parte superiore libera et in valvis 2 loculicide dehiscens. Semina oblonga, magna, plano-convexa, saepe abortu solitaria; testa crustacea atro-castanea facie ventrali hilo orbiculari notata; cotyledonibus magnis corneis inaequalibus marginibus plus vel minus involutis, radicula vix exserta. Arbor magna. Folia subopposita, lanceolata. Flores in capitula vel umbellas 3–7-floras in paniculas terminales dispositi; calycum tubi liberi vel connati. Species 2 (?) moluccanae et papuanae.

Eucalyptopsis papuana sp. nov.

Arbor magna, ubique glabra; trunco recto ad basin anteridifero; ramis patentibus foliorum coronam magnam ferentibus; cortice fusco suberoso plus vel minus laminato; ligno pallido-fusco oleoso; ramulis primum angularibus mox teretibus. Folia petiolata, subopposita, lanceolata, apicem versus angustata, apice ipso acuto, basi cuneata, margine in sicco leviter recurva, subtus pallidiora et opaciora; costa media valida subtus elevata; nervis lateralibus ca. 16 in utroque latere sed non semper nervis intermediis distinctis, venis et venulis subtus leviter elevatis, vena intramarginali nulla; petiolo contorto eucalypto simili, 1–1.5 cm. longo; lamina 12–16 cm. longa, 3.5–5 cm. lata. Flores in capitula 5–6-flora in panicula terminales dispositi. Calyx campanulatus, 1.2 cm. longus, ad oram 7 mm. latus, supra

* Deceased, August 16, 1950.

ovarium 4 mm. longus leviter constrictus et deinde articulatus, parte supra ovarium 8 mm. longa ad apicem in lobos irregulariter disrupto; tubis in capitula connatis vel liberis. Stamina numerosa, 7 mm. longa; filamentis rectis connectivi basim versus affixis. Capsula lignosa, parte inferiore late turbinata vel cupularis, 1.5 cm. diam., parte superiore libera, 7 mm. alta, in valvis 2 loculicide dehiscens. Semina oblonga, plano-convexa, 8 × 5 × 3 mm., testa tenuiter crustacea, atro-castanea, basin versus hilo orbiculari notata.

INDONESIA: Moluccan Archipelago: Boeroe, Balobalo, alt. 100 m., *Neth. Ind. For. Service bb.25162*, July 1938, *bb.31350*, Dec. 1939, and *bb.31361*, Dec. 1939.

BRITISH NEW GUINEA: Western Division: Fly River, 30 miles above D'Albertis Junction, Oroville Camp, *L. J. Brass 7406* (TYPE), Aug. 1936, plentiful in rain-forest canopy layer (very large tree, thick straight bole, crown of massive spreading branches; trunk buttressed at base; bark brown, somewhat scaly; wood pale brown, hard, oily; leaf nerves pale; flowers white). Eastern Division: Milne Bay, Kwato, *J. B. McAdam 10* (large tree; local name "Malaha").

Eucalyptopsis sp. aff. *E. papuana* C. T. White.

NETHERLANDS NEW GUINEA: Hollandia, Berap (Nimboeran), *Neth. Ind. For. Serv. bb.28995.*

Unfortunately the material available to me is very fragmentary, a few broken leaves and a couple of capsules. The leaves differ markedly from those of all the other specimens in being prominently reticulate in the dried stage on both surfaces. A sketch of a perfect leaf sent me by Dr. Perry also shows the apex to be acuminate rather than acute as in the Eucalyptus-like leaves of the other collections. Dr. Dadswell further informs me that the wood shows marked structural differences from *E. papuana*.

Outstanding features of this new genus are: (a) the Eucalyptus-like leaves; (b) the articulation of the calyx tube immediately above the ovary eventually shedding the greater part of the tube and the stamens; (c) the irregular disrupting of the calyx tube at its apex into lobes as far as the very highly placed staminal disk; and (d) the attachment of the stamens in four groups high up in the calyx tube and from which they are suspended in the bud stage.

The genus with most affinity to *Eucalyptopsis*, I should say, is the New Caledonian *Pleurocalyptus* Brongn. & Gris., which differs in having broad non-Eucalyptus-like leaves, free stamens, and an ovary that is almost wholly free from the calyx tube except at its very base, even in the youngest stages. Dr. H. E. Dadswell informs me this is the decision he had come to on the wood structure, though as far as *Pleurocalyptus* is concerned he had only very limited material to examine. The absence of an intramarginal vein in the leaf of *Eucalyptopsis* is a feature that distinguishes it from *Eucalyptus*. In the latter genus I cannot call to mind any species in which it is absent, and its distance from the margin and other features are used as diagnostic characters in the definition of a species.

The leaves of *Eucalyptus* are opposite and in some cases subopposite. This is a comparatively common feature in the juvenile stage. *Eucalyptopsis* comes close to *Syncarpia* Ten. and *Choricarpa* Domin, from both of which it differs in the absence of petals.

Though several sheets are quoted, the material in most cases is very scrappy. When I first drew up the description and had the plate made, only very young buds were available to me. Brass mentioned "fls. white" on his field label, however, and after much searching Dr. Perry managed to find a single fully developed flower. I did not dissect this as everything could be seen more or less from the outside. When more material is available, however, some modifications in the generic description may have to be made.

Eugenia (*sensu stricto*) **salomonica** sp. nov.

Arbor 10 m. alta, trunco basi anteridifero, anteridibus validis dorso rotundatis, cortice laevi pallido-fusco-griseo in fragmentis longis decorticato, ramulis teretibus vel primum indistincte quadrangulatis, internodiis 3–6 cm. longis. Folia glabra, minute vel minutissime sed vix copiose pellucido-punctata, breviter petiolata, elliptica vel elliptico-lanceolata vel fere ovato-lanceolata, basi acuta, apice plus vel minus gradatim acuminata, costa media utrinque prominula, nervis lateralibus utrinsecus ca. 14 utrinque subaequalibus sed tenuissimis et non semper manifestis, vena intramarginali 1–2 mm. a margine remota; lamina 7–9 cm. longa, 3.5–4.5 cm. lata; petiolo 2–3 mm. longo. Flores singuli vel deinde in cymas breves paucifloras dispositi; pedicellis 0.5–1 cm. longis pubescentibus subvalidis; bracteis ad basin pedicellorum et bracteolis sub calyce similaribus angustissime lanceolatis 3 mm. longis. Calyx 4-lobatus, lobis in alabastro valde imbricatis, tubo dense fulvo-tomentoso, lobis (in fructu vel in floribus a quibus petala et stamina delapsa sunt) 7–8 cm. longis 5 cm. latis extus brevissime fulvo-tomentosis, intus prominenter glanduloso-punctatis. Petala (in alabastro modo visa) suborbicularia, 0.5 cm. diam. Stamina numerosa in ordinibus pluribus disposita; disco densissime fulvo-tomentoso. Ovarium biloculatum; stylo glabro. Fructus subglobosus (fide coll. 2 cm. diam. sed vix maturus) in sicco 1.5 cm. diam.

SOLOMON ISLANDS: Bougainville: Kieta, alt. 100 m., *S. F. Kajewski 1574* (TYPE) March 1930, common in rain-forest (small tree up to 6 m. high; petals white-green; stamens white, conspicuous, with light brown semi-transparent anthers). Santa Isabel: Kalina Bay, *F. S. Walker B.S.I.P. 301*, Aug. 1946, common in lowland rain-forest in coral sand (tree 30 ft., buttresses stout rounded, extending into the trunk as flanges; bark smooth, pale brownish grey, shed in long scroll-like flakes, leaving paler patches beneath).

Mearnsia ramiflora (Lauterb.) Diels var. **villosa** var. nov.

Folia magnitudine formaque var. humili Diels (*Metrosideros arfakensis* Gibbs) similia sed ramulis junioribus et intermediis et foliis novellis dense sericeo-villosis; pilis in parte inferiore costae mediae in facie foliorum inferiore persistentibus.

NETHERLANDS NEW GUINEA: Genofo, alt. ca. 1000 m., *Neth. Ind. For. Serv. bb.22565*, April 1937 (communic. ex Herb. Hort. Bog.).

I have followed Diels (Bot. Jahrb. 57: 420. 1922) in regarding *Metrosideros arfakensis* Gibbs as a variety of *Mearnsia ramiflora* (Lauterb.) Diels. Judging from the description and illustration published by Miss Gibbs (Contr. Phytog. & Fl. Arfak Mts. 155. 1917) the present plant is very similar in appearance, the chief difference being that the branchlets and the leaves in the younger stage are densely villose, the hairs persisting on the adult leaves on the midrib of the lower surface.

Mearnsia salomonensis sp. nov.

Arbor parva; plerumque epiphytica, partibus novellis tenuiter sericeis mox glabris, ramulis validis cortice atro-griseo obtectis. Folia petiolata, opposita, lanceolata subcoriacea, margine in sicco leviter revoluta, apice acuminata vel fere caudato-acuminata, basi cuneata, in sicco concoloria vel subtus leviter pallidiora, nervis lateralibus ca. 16 in utroque latere sed subobscuris in venam marginalem 0.5 mm. remotam conjunctis; lamina 7 cm. longa, 2–3 cm. lata; petiolo valido 3 cm. longo. Flores rosei vel rubri in cymas racemiformes ex axillis foliorum delapsorum e ligno vetere dispositi; ramulis pedicellisque tenuiter sericeo-pubescentibus, pedicellis gracilibus ca. 5 mm. longis. Calyx late turbinatus apud oram 5 cm. diam. tubo in parte inferiore valde angustato et 5-costato. Petala rubra, orbicularia, 2 mm. diam., basi in unguem angustata. Stamina 1.3 cm. longa. Ovarium immersum, loculis 4; stylo staminibus aequali. Capsula cupularis vel suborbicularis, 6 mm. diam., 4-locularis in calycem profunde immersa.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field, alt. 100 m., *S. F. Kajewski 1755*, April 1930 (small parasitic tree, growing on large old weathered trees; very seldom seen on the ground; flowers very showy, stamens bright red; Lake Luralu, alt. 1500 m., *S. F. Kajewski 2067* (TYPE: fls. & capsules), Aug. 1930, common in rain-forest (small parasitic tree usually growing on the larger, mossy, gnarled old trees of the higher levels; stamens bright pink, very showy). Guadalcanal: Tutuve Mt., alt. 1700 m., *S. F. Kajewski 2628* (fls.), May 1931, common in poor scrub at high altitudes (small straggling tree with gnarled and twisted branches; fls. scarlet).

Metrosideros parviflora C. T. White in Jour. Arnold Arb. 23: 80. 1942.

SOLOMON ISLANDS: Ysabel: Tiratona, alt. 600 m., *L. J. Brass 3340*, Dec. 1932, common in rain-forest (large spreading tree, branching near the ground; bark pale brown flaky; fls. white); Cape Prieta, alt. 200 m., *L. J. Brass 3471*, Jan. 1933, common in loose soil on dry open slopes (small bushy-topped tree, 5–6 m. high; peduncles and pedicels brown; petals white, stamens green). Guadalcanal: Mt. Tutuve, alt. 1700 m., *S. F. Kajewski 2624*, May 1931, common in poor rain-forest at higher altitudes (small straggling tree with gnarled and twisted branches; fls. cream; fruit pink).

BRITISH NEW GUINEA: Central Division: Mt. Tafa, alt. 2300 m., *L. J. Brass 4030*, May 1933, common in mossy forest (erect tree 40–50 ft.; small crown, trunk corrugated; bark flaky and fibrous; hard red wood; leaves reddish when young, margin recurved; fls. white).

The leaves in *Brass 3471* are more coriaceous and more ovate-lanceolate than lanceolate, probably because of the low altitude and comparatively dry conditions under which the trees are growing. The *Kajewski 2624* specimen is in fruit with the remains of a few flowers here and there. It differs from typical *M. parviflora* C. T. White in having smaller, more coriaceous leaves, lanceolate in outline but not acuminate. I think these differences could be brought about by altitude and exposure.

Metrosideros salomonensis sp. nov.

Arbor magna patens cortice fusco squamato obtecta; ramulis foliisque glabris. Folia opposita, lanceolata, apice caudato-acuminata, basi cuneata, supra subnitida, subtus opaca et leviter pallidiora, et sub lente minute punctata; costa media supra immersa, subtus elevata, nervis lateralibus crebris; vena intramarginali 0.5 mm. remota; lamina 5.5–7.5 cm. longa, 1.5–2.3 cm. lata; petiolo 0.5–0.7 cm. longo supra sulcato. Cymae plures in inflorescentiam terminalem corymbiformem dispositae, bracteis magnis sed mox deciduis, pedunculis subvalidis leviter applanatis trifloris ca. 1.5 cm. longis. Calyx late turbinatus 5-lobatus, tubo in pedicellum angustato, cum pedicello 0.8–1 cm. longo, ad oram 0.6 cm. diam., pilis sparsissime obsito; lobis late triangularibus 2 mm. altis. Petala staminaque cremea vel pallido-flava; petala suborbicularia, 4 mm. diam. Staminibus liberis, filamentis ca. 2 cm. longis, antheris 1.5 mm. longis. Capsula trilocularis, parte majore exserta, parte inferiore immersa sed basi excepta a calyce libera; valvis glandulis oleiferis paucis punctatis.

SOLOMON ISLANDS: Ysabel: Tiratona, *L. J. Brass 3336*, Dec. 1932, mountain forests (large spreading shapely tree with a dark brown scaly bark and very dark red, hard heavy wood; leaves stiff, underside paler, margins almost white; petals fugacious, almost transparent white, stamens cream-coloured); same locality and habitat, *L. J. Brass 3401* (TYPE), Dec. 1932 (large handsome spreading tree with pale brown flaky bark and hard brown wood; leaves dark, stiff, underside pale; petals and stamens very pale yellow, young buds [bracts C. T. W.] red).

Among previously described species from the New Guinea-Solomon Islands region this comes closest to *M. brachyanthera* Diels, which has shortly and obtusely acuminate leaves, a many-flowered inflorescence, and coralline-coloured flowers, the stamens with a dark band above the base.

Metrosideros sp.

SOLOMON ISLANDS: Bougainville: Kupei Gold Field; *S. F. Kajewski 1713*, alt. 1000 m., common in rain-forest (small parasitical tree growing on the old gnarled giants of the tops of the mountains). This specimen is in leaf only and probably represents an undescribed species.

OCTAMYRTUS Diels

The genus *Octamyrtus* was founded by Diels (Bot. Jahrb. 57: 373. 1922) to include *Eugenia pleiopetala* F. Muell. and two other small trees allied to *Rhodomyrtus*. The chief feature is the corolla, which is composed of (6–)8 petals, mostly of a rose-red colour, usually markedly

unequal in size, very imbricate and hiding the essential parts up to a late bud stage. As three new species are here proposed, a revised key to the six known species is given herewith.

1. Flowers in the leaf axils.....2
   Flowers on the older wood below the leaves.....5
2. Calyx lobes rotund or nearly so though sometimes pointed, 7–8 cm. long..3
   Calyx lobes lanceolate to ovate-lanceolate, 3–3.5 cm. long, 0.6–1.8 cm. broad.....*O. insignis.*
3. Petals 2–3 cm. long.....4
   Petals under 1 cm. long.....*O. arfakensis.*
4. Leaves lanceolate, bracts persistent up to the opening of the flower and sometimes later.....*O. lanceolata.*
   Leaves elliptic to broadly lanceolate, bracts early deciduous.....*O. pleiopetala.*
5. Leaves 15–18 cm. long, bracteoles very small; calyx lobes 6–7 mm. long; petals 1.5–2.5 cm. long.....*O. Behrmannii.*
   Leaves up to 70 cm. long; bracts and bracteoles up to 3 cm. long; calyx lobes 2 cm. long; petals 2.3–3 cm. long.....*O. glomerata.*

Octamyrtus arfakensis Kanehira et Hatusima in sched.

Arbor 12 m. alta, ramulis dense pubescentibus junioribus quadrangulatis. Folia anguste ovato-lanceolata, apice acuminata, basi obtusa vel subobtusa, supra deinde glabra vel glabrescentia, subtus in costa media et nervis praecipuis pilis longis densius ceterum sparse obsita; nervis praecipuis 8–10 in utroque latere, supra impressis subtus elevatis arcuatim ca. 5 mm. a margine remotis et plerumque in venam intramarginalem plus vel minus distinctam conjunctis et saepe vena submarginali cum primaria subparallela disposita; lamina 8.5–9 cm. longa, 2.5–3.5 cm. lata; petiolo 1 cm. longo. Flores (in alabastro bene evoluto modo visi) singuli, in axillis superioribus dispositi, pedicellis 5 mm. longis; bracteis linearibus vel anguste lanceolatis 5 mm. longis, dense pubescentibus. Calycis tubus cylindricus, densissime tomentosus, 5 mm. longus; lobis rotundis 4 mm. longis. Petala rosea (fide coll.) subrotunda, ca. 6 mm. diam.

NETHERLANDS NEW GUINEA: Arfak Mts., Angi, alt. 1900 m., *R. Kanehira & S. Hatusima 14028* (TYPE), April 9, 1940, in the forest along the shore of Lake Gita (tree 12 m., fls. pink).

Though the flowering material available to me consists of two very young buds and one well-developed one, I have no hesitation in adopting the collectors' name. I would have preferred to wait for them to publish the description themselves, but Dr. Kanehira is, I believe, dead, and it may be an indefinite time before publication is otherwise made. The species is remarkable on account of the distinct veining of the leaves, but especially because of the very small flowers.

Octamyrtus Behrmannii Diels in Bot. Jahrb. **57**: 376, *fig. 1N*. 1922, et Jour. Arnold Arb. **10**: 251. 1929.

NORTHEAST NEW GUINEA: Sepik River, *Behrmann 6969*.

BRITISH NEW GUINEA: Central Division, Vailala River, *L. J. Brass 1067*.

Octamyrtus glomerata Kanehira et Hatusima in sched.

Arbor 6 m. alta ramulis validis, apicem versus 1.5 cm. diam., junioribus irregulariter quadrangulatis mox teretibus. Folia magna primum dense fulvo-tomentosa, deinde glabra, obovata, nervis lateralibus utrinque ca. 35, apice minute apiculata, basi obtusa (subauriculata ?), lamina 70 cm. longa, 25 cm. lata; peticlo valido 1.5 cm. longo. ·Flores numerosi, in fasciculos glomeratos e ramulis vetustis infra folia orti; bracteae rubro-purpureae (fide coll.), extus glabrae intus basim versus pilis longis appressis obsitae, 2–2.3 cm. longae, 1.5 cm. latae, parte superiore squarrosae parte inferiore late triangulares, basi obtusae, apice peracutae, bracteolis bracteis similibus sed angustioribus et ad 3 cm. longis. Calycis tubus subglobosus tenuiter pubescens 8 mm. diam., lobis 2 cm. longis 2 exterioribus ovato-lanceolatis, 8 mm. latis, 2 interioribus angustioribus lineari-lanceolatis, 3–4 mm. latis. Petala flava (fide coll.) extus tenuiter pubescentia densius basim versus, intus parte inferiore pilis longis appressis dense obsita, 2 exterioribus majoribus 3 cm. longis 1.3 cm. latis, 2 interioribus 2.3 cm. longis 4 mm. latis (in flore uno imperfecto modo viso). Stamina non visa. Stylus glaber 5.5 cm. longus, stigmate capitato.

NETHERLANDS NEW GUINEA: Momi, 60 m. south of Manokwari, *R. Kanehira & S. Hatusima 14126*, April 10, 1940, in dense rain-forest (tree 6 m. high, trunk 10 cm. diam., petals yellow, sepals and bracts reddish purple).

In the habit of flowering on the older wood this species approaches *O. Behrmannii* Diels, but the floral characters of the two species are totally different. In the large bracts and calyx lobes it approaches *O. insignis* Diels, but in this species the flowers are borne singly in the upper leaf-axils. Unfortunately the material available to me is fragmentary. However, the remarks made under *O. arfakensis* Kaneh. & Hatus. regarding the naming of it also apply here.

Octamyrtus insignis Diels in Bot. Jahrb. 57: 374, *fig. 1, A-M*. 1922; Lane Poole, For. Res. Papua & New Guin. 128. 1925; White & Francis in Proc. Roy. Soc. Queens. 38: 251. 1927.

NORTHEAST NEW GUINEA: Dscheregi, *Schlechter 17428, 19431*.

NETHERLANDS NEW GUINEA: Hollandia and vicinity, *L. J. Brass 8867*, June/July 1938, in secondary rain-forest (small tree).

BRITISH NEW GUINEA: Buna District, Wasida, *Lane Poole 163*.

Francis & White l.c. drew attention to a few differences in *Lane Poole 163* from the type. *Brass 8867*, in very young bud, probably belongs here.

Octamyrtus lanceolata sp. nov.

Arbor 6–7 m. alta, cortice fusco in laminis tenuibus delapso, ramulis junioribus quadrangulatis dense fulvo-tomentosis. Folia lanceolata, apice acuta, mucronulata, basi anguste cuneata, supra costa media et saepe

nervis praecipuis tomentosa aliter glabra, subtus costa media et nervis praecipuis tomentosa ceterum glabra pilis sparsissimis excepta; nervis praecipuis 11–13 in utroque latere, supra leviter impressis subtus elevatis, venis et venulis subtus prominulis; lamina 11.17 cm. longa, 4–5 cm. lata; petiolo fulvo-tomentoso, 1–1.5 cm. longo. Flores singuli in axillis superioribus dispositi; pedicellis 4–5 mm. longis; bracteis dense fulvo-sericeis anguste ovato-lanceolatis 7 mm. longis saepe persistentibus postquam petala delapsa sunt. Calycis tubus primum anguste turbinatus deinde subglobosus, 7–8 mm. longus, densissime tomentosus, lobis late rotundis sed apice ipso acuto dense tomentosis, 4–5 mm. longis, 5–6 mm. latis. Petala atro-aurantiaca (orange-red fide coll.), margine ciliolata, inaequalia, exteriora 2 mm. longa, interiora 2.8 cm. longa, 7 mm. lata. Stamina rosea (fide coll.), filamentis gracilibus ad 4 cm. longis, antheris 2 mm. longis. Stylus 6.5 cm. longus, glaber, stigmate capitato.

BRITISH NEW GUINEA: Western Division: Middle Fly River, *L. J. Brass 7701*, Sept. 1936, common in light dry-type rain-forest (substage tree, 6–7 m. high; bark brown shed in thin flakes; petals orange-red; stamens pink).

This species is very closely related to *O. pleiopetala* (F. Muell.) Diels which differs in the elliptic to very broadly lanceolate leaves, in the mostly longer pedicels, and in the bracts being early deciduous. When more material has been collected it may be found that one must take a very broad concept of *O. pleiopetala* and fit these specimens in with it. For the present, however, I prefer to treat them as representing a distinct species.

Octamyrtus pleiopetala (F. Muell.) Diels in Bot. Jahrb. 57: 373. 1922.

Eugenia pleiopetala F. Mueller, Descript. Notes Pap. Pl. V. Add. 106. 1877.

Arbor parva (fide Brass), ramulis junioribus densius pubescentibus subquadrangulatis. Folia elliptica vel fere oblongo-elliptica vel late lanceolata supra deinde glabra costa media et nervis praecipuis basin versus excepta, subtus pilis sparsis obsita vel deinde glabrescentia; nervis praecipuis 8–9 in utroque latere (ad 12 in foliis majoribus in specimine Matapensi *Clemens 11332*); lamina 6–9 cm. longa, 2.5–4.5 cm. lata (ad 17.5 × 8 cm. in *Clemens 11332*); petiolo 5–7 mm. longo (ad 1.5 cm. in *Clemens 11332*). Flores rosei (fide Brass et Clemens); pedicello dense pubescenti 5 mm. longo (ad 1 cm., *Brass 5671* et *Clemens 11332*); calycis tubo dense tomentoso, anguste turbinato 3 mm. longo (ad 7 mm., *Brass 5671* et *Clemens 11332*) lobis rotundis vel oblatis dense tomentosis vel apicem versus glabris, 7–9 mm. diam.; petalis inaequalibus exterioribus brevioribus et latioribus 1.7 × 1 cm., interioribus longioribus et angustioribus 2 × 0.8 cm., ad 2 × 1.3 et 3 × 1.3 cm. (*Clemens 11332*); staminibus numerosis, filamentis tenuibus (in typo 2.5 cm. longis; ad 4.5 cm., *Clemens 11332*), antheris basi fixis 2 mm. longis; stylo glabro, stigmate capitato. Fructus (fide *Brass 11704*) subglobosus in sicco ca. 1.3 cm. diam.

MOLUCCAS: Aru Islands, Lutor, *O. Beccari* (Piante delle Isole Aru), June 1873.

NETHERLANDS NEW GUINEA: Balim River, alt. 1600 m., *L. J. Brass 11704,* Dec. 1938, in a thickly forested gully (straggling tree, 3–4 m. high; fls. reddish pink); Idenburgh River, 4 km. SW of Bernhard Camp, alt. 850 m., *L. J. Brass 13262,* March 1939, rain-forest, occasional in flood plain seral growths (tree 3–4 m., fl. red).

NORTHEAST NEW GUINEA: Morobe District, Matap, alt. 5000–6000 ft., *M. S. Clemens 11309,* Feb.-April 1940 (tree 2 in. diam., fl. bud tip purplish tint), also *11332* (tree 20–30 ft. high, fls. vivid rose-pink).

BRITISH NEW GUINEA: Central Division: Kubuna, alt. 100 m., *L. J. Brass 5671,* Nov. 1933, rare, rain-forest regrowths (small tree, leaves dull, pale-nerved, fls. solitary, axillary, reddish pink, petals closely imbricate around the reproductive organs).

Rhodamnia salomonensis sp. nov.

Arbor parva, cortice fusco, ramulis subvalidis junioribus leviter applanatis mox teretibus. Folia lanceolata vel obovato-lanceolata, apice acuminata, acumine ipso ca. 5 mm. longo, basi acuta, margine leviter recurva, utrinque pilis brevissimis sparse obsita vel deinde fere glabra, prominenter triplinervia, nervis 2 praecipuis oppositis vel alternis supra basin laminae 0.5–0.8 cm. remotis, nervis lateralibus 7–9 in utroque latere, in sicco cum venulis utrinque prominulis, vena intramarginali 0.5–1 mm. remota; petiolo sparse et breviter pubescentis, 0.6–1 cm. longo; lamina 6–10 cm. longa, 3–5 cm. lata. Flores in cymas dichotomas in axillis superioribus dispositi vel inflorescentia in juventute uniflora; inflorescentiae ramulis pedicellis calycibusque dense pubescentibus, pedicellis 4 mm. longis. Calyx 4 cm. diam., 5–6-lobatus lobo uno aliis multo majore. Petala 5 in alabastro valde imbricata, 3–4 mm. diam. Stamina numerosa, filamentis applanatis 4–5 mm. longis, antheris 0.75 cm. longis basifixis, connectivo filamento continuo. Ovarium uniloculare.

SOLOMON ISLANDS: Ysabel: Kakatio, alt. 900 m., *L. J. Brass 3257,* Dec. 1932, common in mountain rain-forests (small brown-barked tree; leaves pale on under surface; fls. coloured pink).

I cannot find any previous record of *Rhodamnia* in the Solomon Islands. However, the finding of the genus there was to be expected. The present species bears no great similarity to any other *Rhodamnia* with which I am acquainted. The anthers with the loculi borne on either side of a rather broad connective which seems continuous with the filament is remarkable. The ovary is 1-celled, but I could find no ovules in the few I examined. It is possible that when fruit is obtained it may prove the tree to be the type of an undescribed genus. On the basis of material at present available, however, I think it should be included in *Rhodamnia* Jack.

Rhodamnia propinqua sp. nov.

Arbor 14–15 m. alta, cortice fusco fibroso rimoso gummi rubrum scatenti ramulis tomentosis. Folia late lanceolata vel ovato-lanceolata,

apice gradatim acuta vix acuminata, basi cuneata, supra glabra in sicco castanea, subtus valde pallidiora, dense tomentosa, trinervia; nervis praecipuis supra impressis subtus elevatis, nervis transversis tenuibus, supra obscuris, subtus leviter elevatis, venulis obscuris; petiolo dense tomentoso, 5–6 mm. longo; lamina 7–9 cm. longa, 2.5–4 cm. lata. Flores axillares singuli vel bini; bracteis ad basin pedicellorum linearibus dense ferrugineo-tomentosis 4–5 mm. longis; pedicellis strictis dense ferrugineo-tomentosis 1.2–1.5 cm. longis; bracteolis sub calyce bracteis similibus. Calyx 4-lobatus, tubo late campanulato dense fusco-tomentoso, 5 mm. diam., lobis late triangularibus utrinque densissime fusco-tomentosis. Petala 4 late obovato vel suborbicularia, 5 mm. longa, 4 mm. lata, extus densissime tomentosa, intus glabra densius pustulato-punctata.

BRITISH NEW GUINEA: Western Division: Tarara, Wassi Kussa River, *L. J. Brass 8555* (TYPE), Dec. 1936, common in substage (fls. white); same locality and date, *L. J. Brass 8592* (substage or lesser canopy tree, attaining 14–15 m. in the rain forests, bark brown, soft, fibrous, fissured, exuding a reddish gum when cut; fls. white).

The present plant undoubtedly comes very close to the Australian *R. Blairiana* F. Muell. and resembles it more closely than it does any of the species previously recorded for New Guinea. I would hesitate to differentiate the two species but for the fact that *R. propinqua* C. T. White is a native of lowland New Guinea and *R. Blairiana* F. Muell. of the mountains of northeast Queensland. The chief difference is that in the former the leaves are trinerved, whereas in the latter they are definitely though only slightly triplinerved with one of the two main lateral nerves coming off from the midrib slightly higher than the other. The leaves of *R. propinqua* C. T. White are larger — especially wider — than those of *R. Blairiana* F. Muell. and on longer petioles; the pedicels also are longer.

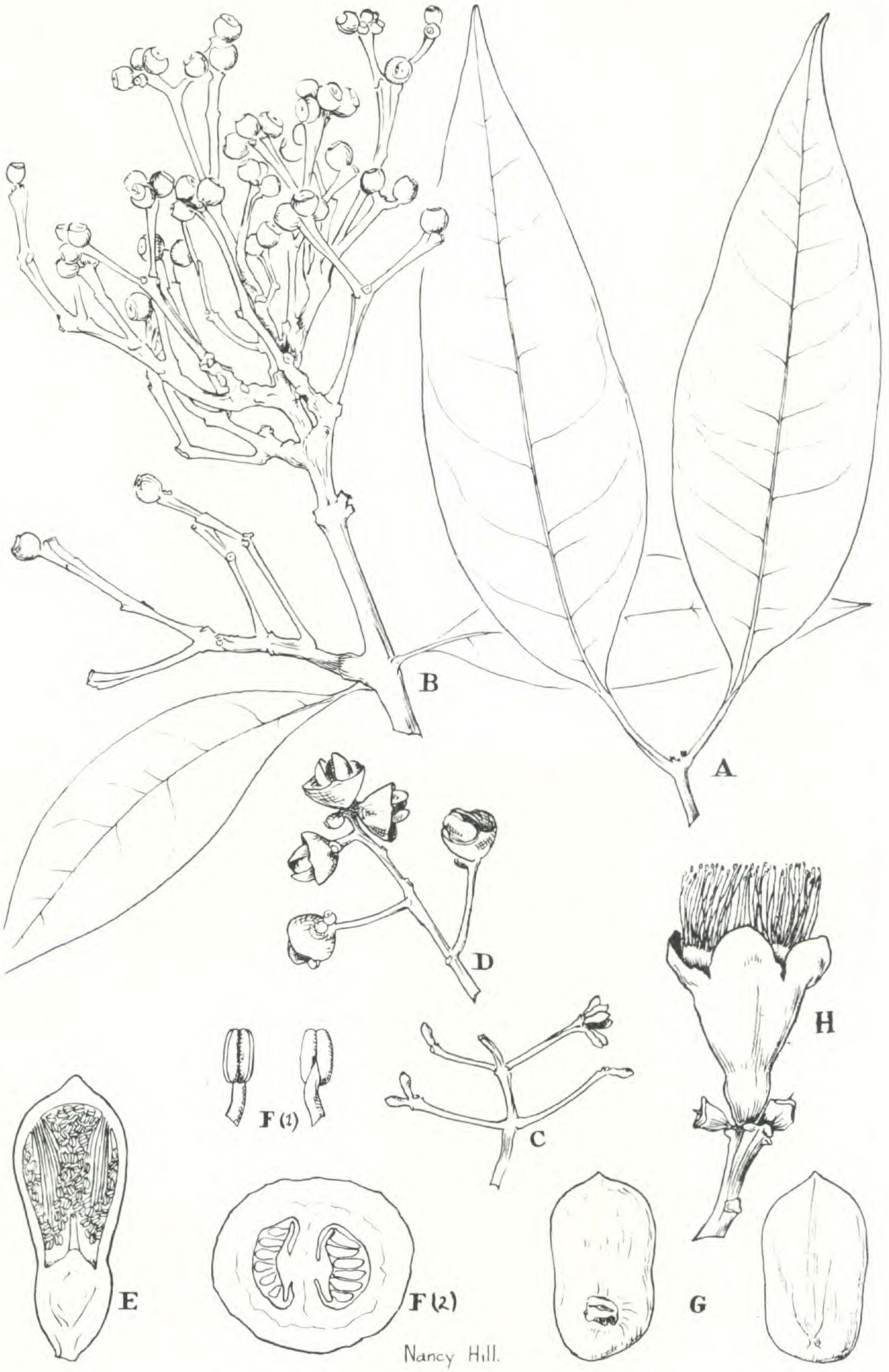
To fit into the key to the New Guinea species published by Diels (Bot. Jahrb. 57: 358–360. 1922) a new group would have to be added as follows:

D. Leaves in the dried state soon becoming brown, under surface lighter brown, slightly tinged with grey in the older leaves, under surface densely tomentose, the tomentum obscuring the ultimate veinlets.

Leaves elliptic to broadly lanceolate, apex gradually long acute, scarcely acuminate. Flowers 1–2 in the axils.....*R. propinqua.*

Rhodomyrtus obovata sp. nov.

Arbor 10–15 m. alta, cortice crasso plus vel minus suberoso laminato, atro-fusco inciso; ramulis subvalidis, junioribus angulatis dense fusco-pubescentibus. Folia obovata, elliptica vel elliptico-oblonga in sicco margine leviter recurva, apice obtusa, basi subobtusa, vel acuta supra costa media pubescentia, nervis venisque primum tenuiter pubescentia mox glabra, subtus pilis densioribus et persistentioribus; nervis praecipuis 5–6 in utroque latere, supra leviter impressis, subtus elevatis; petiolo 1.5–2 cm. longo dense pubescenti; lamina 6–9 cm. longa, 3–6 cm. lata. Flores singuli, sessiles in axillis superioribus; bracteis sub calyce linearibus 3 mm.



EUCALYPTOPSIS PAPUANA C. T. WHITE

longis dense pilosis. Calycis tubus dense griseo-piiosus, 5 mm. longus; lobis 4 extus dense griseo-pilosis. Petala oblonga vel plus vel minus obovata, 1 cm. longa, prominenter et dense glanduloso-punctata. Stamina numerosa, petala aequantia; filamentis leviter applanatis; antheris connectivi basin versus dorsifixa. Stylus glaber, validus; stigmate incrassata crasse discoidea.

BRITISH NEW GUINEA: Western Division: Mabaduan, *L. J. Brass 6566,* April 1936, common and conspicuous in savannah forest (tree 10–15 m., bark thick somewhat corky, layered, chocolate brown when cut); Tarara, Wassi Kussa River, *L. J. Brass 8678* (TYPE), Jan. 1937, common in rain-forest along streams (small tree, fls. white).

The present species at first glance is very like *R. macrocarpa* Benth. of Queensland and New Guinea, but the two can be easily distinguished as follows:

Leaves broadly lanceolate or elliptic-lanceolate, apex acute or acuminate, lateral nerves 7–9 on each side of the midrib; flowers in axillary cymés.. .....*R. macrocarpa.*

Leaves obovate, elliptic or elliptic oblong, apex obtuse, lateral nerves 5–6 on each side of the midrib; flowers solitary in the upper axils..*R. obovata.*

EXPLANATION OF PLATE

Eucalyptopsis papuana gen. et sp. nov. [Figures A, B, F_2, H, drawn from the type-collection, *L. J. Brass 7406;* the others from the Moluccan collections.] *Fig. A.* Leaves. *Fig. B.* Branchlet with young infructescence. *Fig. C.* Part of inflorescence. *Fig. D.* Capsules. All 2/3 nat. size. *Fig. E.* Flower bud in longitudinal section, × 6. *Fig. F*(1). Anther, front and back view, × 14. *Fig. F*(2). Ovary, transverse section, × 6. *Fig. G,* Seeds, front and back view, × 3. *Fig. H.* Flower, × 2.

BOTANIC MUSEUM AND HERBARIUM,
BRISBANE, QUEENSLAND, AUSTRALIA.

WOOD ANATOMY IN THE GENUS EUCALYPTOPSIS WHITE *

H. E. DADSWELL AND H. D. INGLE

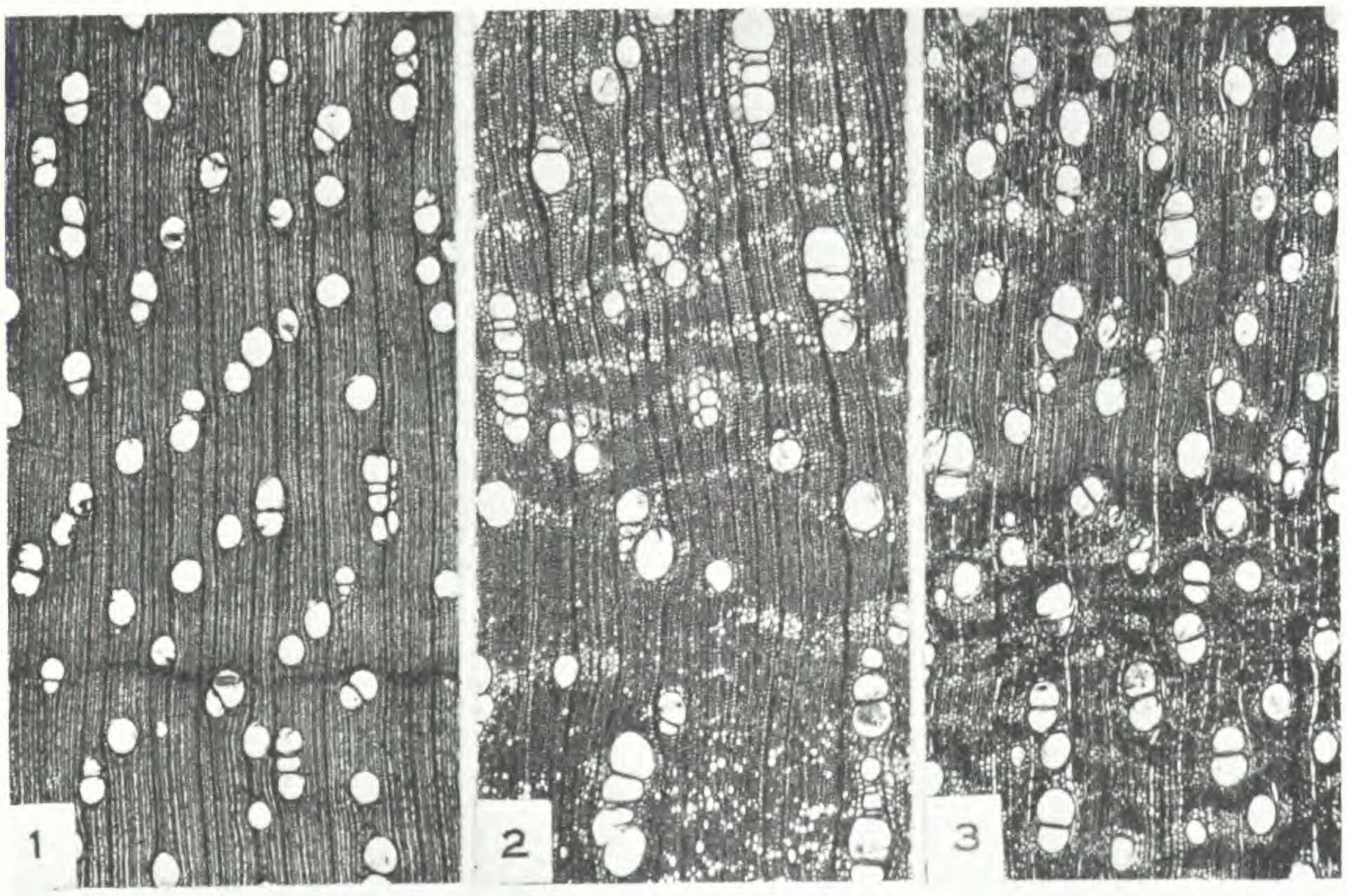
With one plate

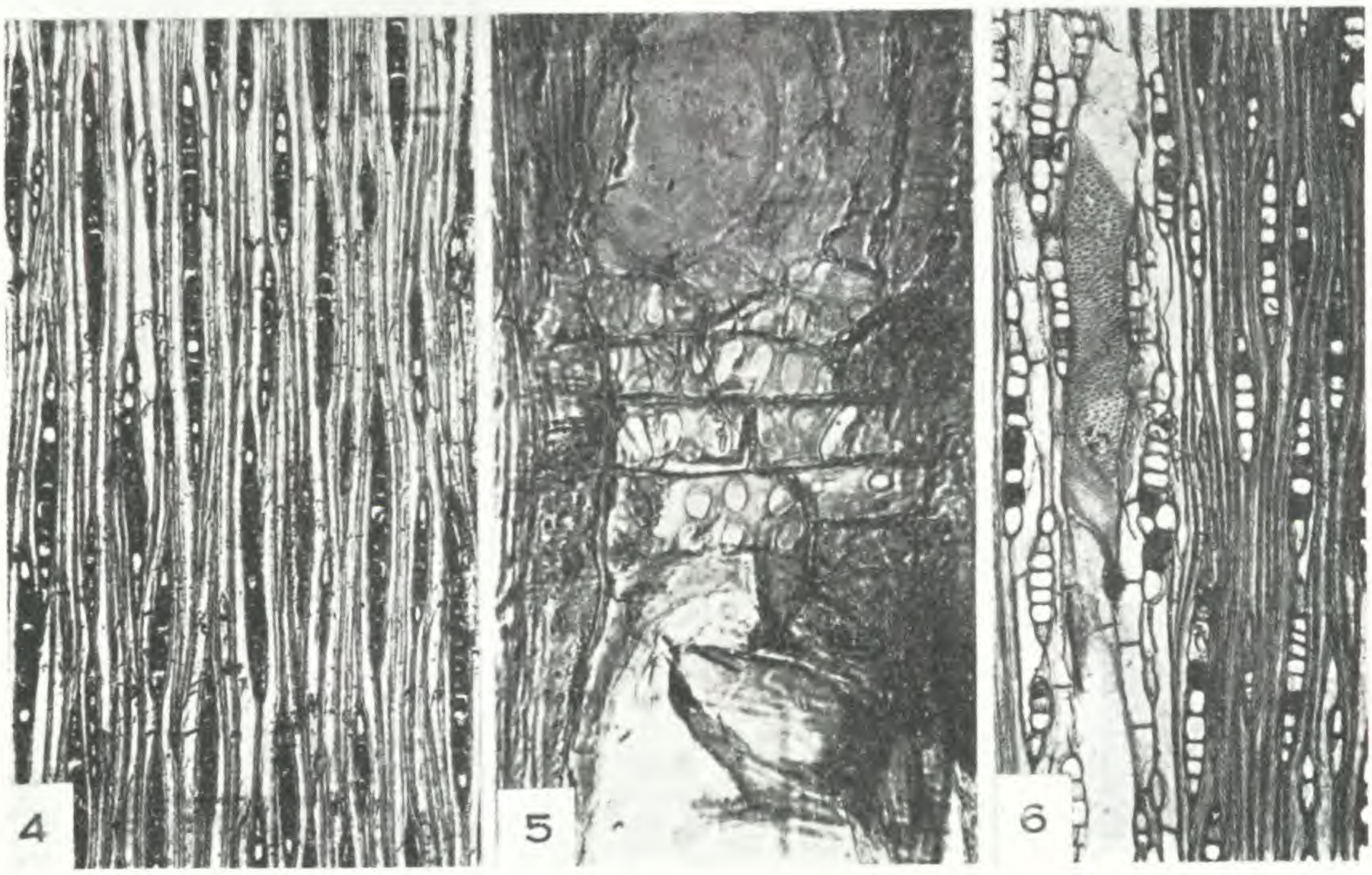
SIX WOOD SAMPLES of the genus *Eucalyptopsis* White, stated to belong to the Myrtaceae, have recently been received through the courtesy of the Director of the Botanic Gardens, Buitenzorg. The heartwood of these samples is pinkish to red-brown; moderately fine textured and without figure; grain straight to somewhat interlocked; density varying from light (23 lb./cu. ft. air-dry at 12 per cent. moisture content in Neth. Ind. For. Serv. *bb.28995*) to moderately heavy (45 lb./cu. ft. in Neth. Ind. For. Serv. *bb.31350*).

Material: — Neth. Ind. For. Serv. *bb.21498*, *bb.25162*, *bb.25163*, *bb.31350*, and *bb.31361* from Boeroe Is., Moluccas; Neth. Ind. For. Serv. *bb.28995* from Dutch New Guinea.

Structure: — GROWTH RINGS moderately well defined in all samples but *bb.28995*, by somewhat thicker walled fibres; in samples *bb.28995* and *bb.31350* there are one or two apparent initial bands of parenchyma which because of their discontinuity and their absence in some areas are believed to be of traumatic origin. VESSELS varying from 20–40 per cent. solitary, the remainder in radial and oblique multiples of 2–3 occasionally up to 4, with a few clusters; sometimes an oblique arrangement of vessels and vessel multiples is apparent; maximum tangential diameters varying from 150–220μ; perforation plates simple; intervessel pitting moderately coarse, bordered, alternate, vestured; diameter of borders 7–12μ; length of vessel members 580–790μ; tyloses abundant. VASICENTRIC TRACHEIDS absent. RAYS generally uniseriate (up to 70%) to partly biseriate, in *bb.31350* up to 45% biseriate; weakly heterogeneous with at least one row of upright cells and one to several rows of squarish cells at margins of rays; many uniseriate rays composed of square to upright cells; low, maximum height up to 15 cells; vessel-ray pitting coarse, half-bordered, but appearing simple with wide aperture, oval to generally vertically elongated; deposits of extraneous material abundant throughout ray cells in all samples but *bb.25162* where they are sporadic and are different in appearance; no silica or crystals observed. PARENCHYMA predominantly paratracheal, varying from incompletely vasicentric to abundant paratracheal aliform to confluent; apotracheal parenchyma varying from very sparse diffuse to moderately sparse in those with paratracheal aliform parenchyma (*bb.28995* has sparse paratracheal and sparse diffuse parenchyma, while *bb.25162* has abundant

* See Jour. Arnold Arb. 32: 139. 1951.





DADSWELL & INGLE, EUCALYPTOPSIS

confluent parenchyma and apotracheal diffuse); no crystals or silica observed. FIBRES: thin to moderately thick walled, nonseptate with simple to indistinctly bordered pits, few and inconspicuous; fibre length varying from 1.05–1.20 mm.

Discussion: — Examination of the above material seems to indicate that only one genus is concerned. There may, however, be more than one species represented, since *bb.28995*, although from a different locality, shows a somewhat different structure. However, the material is insufficient on which to base more than conjecture.

With regard to the affinities of this new genus with other genera of the Myrtaceae the following characteristics are noteworthy.

The absence of vasicentric tracheids and of fibre tracheids would indicate a close affinity with genera of one section of the *Eugeniinae*, i.e., *Syzygium*, *Piliocalyx*, *Acmena* and *Cleistocalyx*, rather than the other section which includes *Eugenia* (*sensu strictiore*).

The presence of predominantly paratracheal parenchyma and the high percentage of vessel multiples also substantiates this view. On the other hand the type of ray is unlike that predominating in the section *Eugeniinae*, and also the great majority of genera of the *Myrtoideae*, and in this feature, as also in the vessel-ray pitting, there is a somewhat striking resemblance to the section *Eucalyptinae* of the *Leptosperinoideae* (see Plate I, figs. 5 and 6). In this plate (see fig. 2) a transverse section of *E. corymbosa* of the 'bloodwood' group has been included for comparison of pore size and distribution and parenchyma distribution; the superficial resemblance is most marked.

EXPLANATION OF PLATE

FIG. 1. Transverse section of *bb.28995* showing pore size and arrangement and sparse paratracheal parenchyma, × 25. FIG. 2. Transverse section of *Eucalyptus corymbosa* Sm. showing superficial similarity with *bb.25162* (Fig. 3) in parenchyma distribution and pore type, × 25. FIG. 3. Transverse section of *bb.25162* showing paratracheal aliform and sparse diffuse parenchyma also vessel multiples, × 25. (N.B. In other samples examined the parenchyma distribution is intermediate between Figures 1 and 3 but in general tending towards Figure 3.) FIG. 4. Tangential longitudinal section of *bb.31361* showing low, predominantly uniseriate rays and abundant deposits of extraneous material, × 90. FIG. 5. Radial longitudinal section of *bb.25162* showing vessel-ray pitting characteristic of all samples, × 320. FIG. 6. Tangential longitudinal section of *bb.25162* showing sporadic distribution of extraneous material in ray cells, × 90.

DIVISION OF FOREST PRODUCTS,
C. S. I. R. O.,
MELBOURNE, VICTORIA, AUSTRALIA.

STUDIES IN THE THEACEAE, XXII
SOME NEW SPECIES OF THEACEAE IN SOUTH AMERICA

CLARENCE E. KOBUSKI

Freziera retinervia Kobuski, sp. nov.

Arbor; ramis glabris subcostatis, ramulis teretibus glabris brunneis, gemmis terminalibus glabris. Folia coriacea, glabra, elliptica vel ovata, subinaequilateralia, apice late acuta, retusa, basi cuneata, 5–7 cm. longa et 1.5–2.5(–3) cm. lata, venis ca. 20 paribus, undique manifeste reticulatis, margine crenato-serrulatis, subrevolutis, juventute glandulo-denticulatis, petiolis 1–1.7 cm. longis. Flores axillares, ut videtur solitarii; pedicellis teretibus, glabris, 7–10 mm. longis, erectis vel recurvatis; bracteolis 2, glabris, suboppositis, basi calycis positis, late ovatis, ca. 1.5 mm. longis, 1–1.2 mm. latis, margine ciliatis; sepalis 5, imbricatis, glabris, lato-ovatis vel subrotundatis, 2–3 mm. longis et 2–3 mm. latis, crassis, margine ciliatis; petalis 5, ovatis 6 mm. longis, 3 mm. latis, apice acutis; staminodiis 6, disco affixis, ca. 2.25 mm. longis, filamentis subglobosis, ca. 0.75 mm. longis, antheris ca. 1.5 mm. longis; ovario glabro, ovoideo-conico, ca. 4 mm. longo, basi ca. 2 mm. diametro, triloculare, stigmate trilobulato. Fructus non visus.

COLOMBIA: Departamento Norté de Santander: Cordillera Oriental, región del Sarare; Alto de Santa Inés, bosques, alt. 2150–2250 m., *J. Cuatrecasas, R. E. Scultes & E. Smith 12425* (United States National Herbarium, TYPE; fragment, Arnold Arboretum), Oct. 19–23, 1941.

This species is distinctive because of the complete lack of pubescence even on the terminal buds, the sharply etched reticulation of the leaves, conspicuously so on both surfaces, and the very small flowers. It appears to resemble most closely Sandwith's species, *F. microphylla*. However, in the latter species a distinctive pubescence is found on the branchlets, leaves, pedicels, bracteoles, and calyx, the leaves measure only to 2.5 cm. in length with a petiole only 1 mm. long.

Ternstroemia cleistogama Kobuski, sp. nov.

Arbor omnino glabra, ca. 10 m. alta; ramulis verticillatis vel subverticillatis, griseis, teretibus. Folia coriacea, apice ramulorum congesta, obovata, 5–7 cm. longa, 2–3.5 cm. lata, apice obtuse acuta vel obtusa, basi cuneata, subtus leviter punctata, margine subintegra vel leviter glandulosa, costa supra canaliculata, subtus elevata, nervis undique indistinctis, petiolis 5–7 mm. longis. Flores solitarii, apice ramulorum positi, pedicellis 2.5–3 cm. longis, teretibus, tenuiter erectis vel suberectis; bracteolis 2, inaequalibus, orbicularibus vel semi-orbicularibus, 3.5 × 5 mm. et 3 × 3 mm., apice pedicelli positis; sepalis 5, imbricatis, subrotundatis, inaequalibus, exterioribus duobus ca. 6 mm. longis et 6.5 mm. latis,

interioribus tribus concavis, 7–8 mm. longis et latis; corolla cleistogama, globosa vel subglobosa, circiter 5–6 mm. diametro, basi pentagona; staminibus numerosus, 3- vel 4-seriatis, inaequalibus, 3–4 mm. longis, in cavo corollae confertis, filamentis connatis, 1.5–2 mm. longis, antheris oblongis 1.5–2 mm. longis; ovario subplano, ca. 3 mm. diametro, biloculato, loculis 2-ovulatis, stylo 2–2.5 mm. longo, stigmate peltato bi-crenato. Fructus non visi.

ECUADOR: Loja: between Tambo Cachiyacu, La Entrada, and Nudo de Sabanillas, alt. 2500–3500 m., *J. A. Steyermark 54421* (TYPE, Chicago Museum of Natural History; ISOTYPE, Arnold Arboretum), Oct. 7, 1943 (tree 10 m.; pedicel curving downward, pale green tinged with rose, the calyx greenish white).

This is the third cleistogamous species of *Ternstroemia* described from South America. The other two species are *T. globiflora* R. & P. from Peru and *T. congestiflora* T. & P. from Colombia. The more closely related is *T. congestiflora*, which can be separated from this species by the heavier coriaceous leaves with the veins clearly distinct on the lower surface and the thick short pedicels (3–4 mm. long).

Ternstroemia urophora Kobuski, sp. nov.

Arbor parva, ramulis glabris teretibus crassis, ca. 0.5 mm. diametro. Folia glabra, coriacea, apice congesta, oblongo-elliptica, 14–17 cm. longa, 5–5.5 cm. lata, apice abrupte acuminata, acumine tenui ca. 2 cm. longa, basi cuneata in petiolum crassum ca. 2 cm. longum, margine integerrima, plana vel leviter subrevoluta, costa supra canaliculata, subtus rotundato-carinata, venis 10–12 paribus, undique obscuris vel subobscuris. Flores axillares, solitarii, apice ut videtur congesti; pedicellis crassis, 5–7 mm. longis, glabris, subrecurvatis; bracteolis 2, persistentibus, oppositis, glabris, subaequalibus, ca. 4 mm. longis et 3 mm. latis, late ovatis, apice abrupte subcaudatis, costatis, margine eglandularibus; sepalis 5, imbricatis, glabris, subaequalibus, 5–5.5 mm. longis et ca. 6 mm. latis, late ovatis, apice abrupte leviterque acuminatis, margine membranaceis, integerrimis; petalis 5, late ovatis, apice caudatis, 5–6 mm. longis, basi 2–3 mm. connatis; staminibus 40 plus minusve, ut videtur quadriseriatis, longitudine usque ca. 4 mm. variabili, filamentis omnino connatis, glabris, antheris uniformibus plus minusve, ca. 2.5 mm. longis, apice longe caudatis; ovario glabro, late conico, basi ca. 3 mm. diametro, apice in stylum gradatim, 4-loculato, loculis uno-ovulatis, stylo glabro, ca. 3 mm. longo, stigmate punctiformi. Fructus ignotus.

BRAZIL: Amazonas: Manáus (Manaos), Rio Tarumá-mirí, matinha marginal d'uma campina arenosa; arvore pequem, flôr côr de rosa, *A. Ducke 1288* (TYPE, Arnold Arboretum; ISOTYPE, United States National Herbarium), July 17, 1943.

This species is distinctive because of its caudate or subcaudate parts. The leaves, bracteoles, petals, and anthers are of this form. The four-celled ovary with a single ovule in each cell and the punctate stigma are features of distinction.

In leaf-characters this species resembles *T. circumscissilis* Kob. However, in the latter species the leaf-surface is distinctly glandular-punctate, the ovary two-celled, and the stigma peltate.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

FORSYTHIA POLYPLOIDS

BEAL HYDE

With one plate

THE PRODUCTION OF AUTOPOLYPLOIDS in ornamental plants has been of value in producing larger flowers in snapdragons, zinnias, lilies and other herbaceous plants. Few polyploids have been produced in woody plants, presumably due to the greater difficulties in inducing polyploids and the greater length of time required to evaluate results.

Colchicine-induced polyploids have been obtained in *Syringa, Philadelphus* and *Forsythia* at the Arnold Arboretum. The work with *Forsythia* has been carried far enough to demonstrate the value of polyploidy in the production of ornamental shrubs. In 1939, seedlings of *F. intermedia spectabilis* were treated with colchicine in various ways. One tetraploid was obtained which has been given the varietal name "*Arnold Giant*." The plant is rather stiff in growth habit, and the large deep yellow flowers do not open fully, but the flowers are very attractive, especially as cut flowers. Unlike most forsythias, the *Arnold Giant* is not easily propagated from cuttings.

The tetraploid was backcrossed with *F. intermedia spectabilis* and several dozen triploid seedlings were obtained. They varied considerably in size and growth habit, but in all cases, with one exception, the flowers were relatively uniform in size, although showing a considerable range in depth of color. One of the triploids was exceptional in both vigor of vegetative growth and flower size. As a three-year-old plant it produced new shoots more than six feet tall, and the flowers were considerably larger than those of the other triploids, or even the tetraploid parent. The diameter of the open flower averaged about 6.0 cm. compared with 4.5 cm. for *F. intermedia spectabilis* and 5.5 cm. for *Arnold Giant*.

The large size of this exceptional plant suggests that it might be a hexaploid, but chromosome counts from pollen mother cells and from leaf tip smears verified its genetic origin as a triploid. Pollen grain size is intermediate between that of the diploid and the tetraploid. There was the possibility that this plant might be a periclinal chimera, since such chimeras are produced occasionally in colchicine treated plants. Cross sections of stems showed that the exceptional triploid was intermediate in all tissues. Stem sections of a diploid, the exceptional triploid, and *Arnold Giant* forsythia are shown in plate 1. There is no evidence of a periclinal chimera in the triploid. Evidently the large size of the exceptional triploid can be attributed to genetic recombination. The diploid parent was *F. intermedia spectabilis*, and the tetraploid parent was a seedling of the same species. *Forsythia intermedia spectabilis* is a

hybrid between *F. viridissima* and *F. suspensa,* so that considerable genetic variation would be expected.

Of the several dozen triploids grown, six were selected for further testing. It has been possible to select various types of growth habit from drooping to upright. Flower color ranges from light yellow to a deep yellow. All of the triploids tested have been easily propagated from cuttings. All of the selected triploids have short styles as has the tetraploid parent, so that backcrosses with the tetraploid cannot be continued. The triploids have been crossed with long styled diploids, but so far viable seeds have not been obtained. The *Arnold Giant* has been crossed with *F. ovata* to obtain hardier triploids and greater variation in flower color.

This work has shown the value of triploids in ornamental breeding work. Similar results have been obtained with ornamental apple species. Where the progeny can be perpetuated vegetatively, the production of triploids may be of great value in ornamental horticulture.

DESCRIPTION OF PLATE

PLATE I

FIGURES 1, 2 and 3. Photographs of pollen grains of diploid, triploid and tetraploid forsythias.

FIGURES 4, 5 and 6. Stem cross sections of diploid, triploid and tetraploid forsythias. There is no evidence of a periclinal chimera in the triploid even though it is an exceptionally large plant.

BUSSEY INSTITUTION,
HARVARD UNIVERSITY.

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NOTES ON ELAEOCARPUS LINNAEUS

E. D. Merrill

The present paper owes its origin to an attempt on my part to order up the unnamed specimens in the large Clemens collection of Bornean plants in the herbarium of the Arnold Arboretum, in terms of Dr. R. Knuth's somewhat faulty recent work.[1] In his series of papers published between 1938 and 1941, the last two of which were not available to botanists outside of Germany and certain neighboring countries until after the close of the second World War, he described eighty new species, mostly from the Malaysian-Philippine-Papuasian regions. In no case did he indicate the minor group (section) to which the species might belong, and only rarely did he indicate previously described species to which his proposed new ones might be allied. When I wrote the first draft of this introduction the phrase "somewhat faulty work" appeared as "unrealistic work"; I suspect that the original draft is nearer the truth. In scanning the Knuth descriptions it is noteworthy that in many cases he does not mention the special petal, anther, ovary, and ovule characters that might enable a future worker to place his species in any of the proposed systems of classification. Often it was impossible for him to determine these characters, for many of his original descriptions were based on unsatisfactory specimens, either those where only very young flower buds were present, or in more numerous cases where no flowers, but only fruits, were available. However, as other authors have proposed and described new species on the basis of such incomplete specimens, perhaps it is unfair to single out any particular person for criticism.

It is assumed that these Knuth papers were only preliminary to a projected monograph of the group; and a careful and critical monograph is indeed a very great desideratum. Whatever the plan, work was apparently interrupted by war conditions and it was naturally abandoned when the Berlin herbarium was destroyed by fire in a bombing raid on the night of March 1–2, 1943. All special information that I have received leads me to conclude that all the Berlin *Elaeocarpus* types were destroyed in that botanical catastrophe. This explains those entries where I have included notes on certain species indicating where isotypes may be found, or where I have found other collections from the type locality which agree with the descriptions of the species involved. With the destruction of the Berlin herbarium, and a few years later when the large herbarium in Manila was burned by the Japanese, with its numerous types, all future workers in this difficult genus will be handicapped because so many holotypes no longer exist.

[1] **Knuth, R.** Elaeocarpaceae novae. Decades 1–2. Repert. Sp. Nov. **44**: 124–132. 1938; Decades 3–4, op. cit. **48**: 72–79. 1940; Decades 5–6, op. cit. **49**: 66–73. 1940; Decades 7–8, op. cit. **50**: 81–88. 1941.

When I initiated the task I assumed that it would be simple routine, but I soon noted that, for one reason or another, Knuth had described the same species twice under different names, the two descriptions not based on the same individual number, but on different numbers of the same collection, one in fruit, the other in flower. As these specimens were from exactly the same locality and altitude, but prepared at different dates, I suspect that, at least in some cases, the two collections were gathered from the same tree. Then having described various Philippine and Bornean species on my own account, I realized as I handled certain numbers that I had described the same species under a different name at an earlier date, and in at least one case, a Philippine species, the type of the new Knuth species as of 1940 was actually a duplicate of the type of a Merrill species described in 1907. What I have attempted to do in this paper is to correlate in some degree the independent work of various authors, including myself, Ridley, A. C. Smith, Stapf, and others, with that of Knuth.

Within the last six decades several workers have studied the genus. King, working at Calcutta, had treated the Malay Peninsula species (23 in 1891), followed by Ridley in 1922 (27 species), and Corner working in Singapore subjected these British Malayan species to a critical reconsideration in 1939, recognizing 30 species. Koorders and Valeton at Buitenzorg had considered the Javan species and a few from other parts of the Malay Archipelago. Mr. Elmer and myself, working in Manila, had studied the Philippine representatives, and in 1917 I described various Bornean species; and Ridley in 1938 worked over the Bornean material at Kew with additional new species. Important data were published by Adelbert, Blumea 6: 310–313. 1948, and by Airy Shaw, Kew Bull. 1949: 163–165. 1949. Any botanist, no matter where he works, unless he borrows extensively or travels to the several important centers where types are preserved, is always handicapped for the simple reason that he does not have access to a great many of the actual types, often not even access to duplicates or isotypes, and thus has to depend on the not always satisfactory published descriptions. Many of these descriptions, particularly the earlier ones, are short, or incomplete, or generalized, sometimes even inaccurate, and various modern ones are faulty. Some of us have worked too hurriedly, as manifestly did Knuth. These are some of the factors with which all botanists are involved if they elect to work in this now distinctly protean genus. When one has an opportunty of examining historical specimens, as I did at Leiden, Utrecht, and London in the summer of 1950, the result shows a rather high percentage of reductions to synonymy of the optimistically proposed and described species of this or that author, naturally including myself. In the course of study I have examined the extant types, or isotypes, of most of the Malaysian and Philippine species, and many of the Papuasian species. In spite of the destruction of the Berlin and Manila holotypes, representatives of many of the actually described species may be found in other herbaria in the form of distributed duplicates.

The first paper prepared in this series was a short article for the C. T. White memorial issue of the Proceedings of the Royal Society of Queensland. Here I noted that no less than 220 binomials had been proposed in *Elaeocarpus* previous to 1900, and that since that date approximately 330 additional ones had been published. The total now is about 550 binomials not considering those synonyms that have been published under a dozen other generic names which all modern authors consider to be synonyms of the original Linnean *Elaeocarpus*. Of approximately 550 *Elaeocarpus* binomials, I have indicated the reductions of about 90 to synonymy, 17 from among those published before 1900, the others published within the past fifty years. Some of these reductions were due to factors with which we are all familiar, the priority and homonym rules, differences of opinions as to what the limits of this or that species may be, and lack of access on the part of certain authors to authentically named specimens representing many of the earlier described species. However, in the indicated reductions of about 70 of the 330 new binomials published since 1900, it is suspected that much of the mortality was due to the hurried work of various authors, including myself. Of the 80 new species proposed by Knuth between 1938 and 1941, twenty five percent have been reduced to previously described ones. I am confident that all or most of these reductions will stand the test of time, as I had the opportunity of making direct comparisons where, in a number of cases, authentically named specimens representing species described by other authors were not available to Knuth. I am certain that additional reductions will be made when a really critical monograph is prepared. There is, of course, always the personal factor involved. Some will interpret this or that assemblage as representing a collective species, such as *Elaeocarpus floribundus* Blume, *E. stipularis* Blume, *E. sphaericus* (Gaertn.) K. Schum., and others, and perhaps in some cases subspecies and varieties will be invoked. Undoubtedly others will tend to subdivide even to the point of perhaps describing specimens as contrasted to characterizing species.

Bentham and Hooker f. in 1862, most conservatively estimated that there were then about 50 species in the genus, recognizing the sections *Ganitrus, Dicera, Monocera,* and *Acronodia.* Twenty-eight years later K. Schumann also conservatively thought that there might be more than sixty species, accepting the same sectional names. Schlechter, Bot. Jahrb. 54: 107–146. 1916, for the then-known New Guinea species, set up a new series of minor categories, as sections, in *Lobopetalum, Dactylosphaera, Chascanthus, Fissipetalum, Ptilanthus, Oreocarpus, Blepharoceras, Papuanthus,* and *Coilopetalum,* abandoning the four earlier proposed ones. This new system was primarily based on the number of ovules in each cell of the ovary, two, or four, or six to twelve, plus certain other ovary and some petal characters. However, as one attempts to correlate earlier described species with the Schlechter system, it is noted that very few of those who have considered the Chinese, Indo-Malaysian and Micro-

nesian species specified the number of ovules to the cell, although Pierre, Fl. Forest. Indo-Chine **2**: *pl. 138–150.* 1888, was an exception, and Gagnepain in his treatment of the 48 Indo-China species, Fl. Gén. Indo-Chine Suppl. 1: 475–500. 1945, although he usually indicated the number and arrangement of the ovules, did not use this character as a basis for defining minor categories or sections; in fact he abandoned the section idea entirely. In any case, short of re-examining types or authentically named specimens representing a large majority of the species described to date, it is impossible, from the published descriptions alone, where individual authors failed to indicate the number of ovules, to place more than a small percentage of the recently described species in any proposed section. The situation is further complicated by a fairly large number of species which were described from fruiting specimens, and some where the flower buds were so very young that it was difficult or impracticable to count the ovules. It is assumed, as Knuth did not indicate the number and arrangement of the ovules for his eighty new species, that he did not accept the Schlechter system; in any case his species cannot, in very many cases, be placed in any proposed section because of incompleteness of the descriptions in that, what some authors would consider to be essential characters are not mentioned, even if the material studied was of such a nature that these characters could have been determined.

Elaeocarpus, as it is so extensively developed in the Indo-Malaysian and Papuasian regions, is essentially characterized by its species being largely confined to the primary forests. The trees occur from sea level to the limits of the forests on the higher mountains; and altitude is an important limiting factor in the distribution of individual species. Like the other large genera that for the most part are confined to the primary as contrasted to the secondary forests in Malaysia, and those now vast areas where the character of the original vegetation has been greatly altered by the activities of man, *Elaeocarpus* is characterized by a few widely distributed and perhaps sometimes more or less collective species, and by a very high percentage of local endemics. A surprisingly high percentage of these local species are strongly marked entities, with, as far as available collections indicate, little or no evidence of intergrading forms. In some complexes certain authors have invoked the collective species concept, as intergrades between this and that form, which some have considered to represent distinct species, apparently do occur. This matter of a few widely distributed species versus many local ones applies to particular parts of tropical Asia, as well as to all of the medium and larger islands of the vast Malay Archipelago. Thus at least one-half of the 48 species recorded from Indo-China are known only from that country. The local endemism is distinctly higher in Borneo than it is in Sumatra, Java, or the Malay Peninsula, but this may change as the Sumatran flora becomes better known. Local endemism in the Philippines and in New Guinea is very high indeed, and this apparently applies to the larger islands between Java and New Guinea and south of the Philippines. There seems to be a tendency for certain species to extend

over the Malay Peninsula, Sumatra, Java, and Borneo; and occasionally one of these will occur in the neighboring parts of the Philippines. This is a natural range for in Pliocene-Pleistocene times the Sunda islands (Sumatra, Java, Borneo, and the associated small islands on the continental shelf) were connected with southern Asia through the Malay Peninsula.

Because of the striking characters in the distribution pattern of *Elaeocarpus* species the genus was selected to illustrate the great attenuation in the numbers of species as one progresses eastward from Malaysia.[2] The extraordinary number of species in the Indo-Malaysian, Papuasian, Australian and New Caledonian areas is in very sharp contrast to the situation in the Pacific islands where *Elaeocarpus* species are few, and in the extreme eastern limits of Polynesia, one only. The same situation applies to all the large and characteristic genera of the old world tropics, such as *Ficus, Antidesma, Syzygium, Canarium, Sterculia, Saurauia, Dendrobium*, and many others.

One must always keep in mind that in the great archipelago there are vast areas here and there that have never been visited by botanists and collectors, so that as exploration progresses and the resulting collections are studied, the picture changes very rapidly. Thus in 1900 there were known from the Philippines but 4 species; today the number is approximately 50. The figures for Borneo and for New Guinea are equally striking; Borneo with about five species in 1900, and at least 50 now; New Guinea with perhaps eight species in 1900 and at least 120 now.

This same situation, inadequate exploration and resulting inadequate collections, is further demonstrated by the fact that in the Arnold Arboretum herbarium alone, which is not rich in Malaysian material as compared with the reference collections in certain European institutions, there are today at least 25 apparently undescribed species which are represented by inadequate specimens, sometimes sterile, sometimes with very young flower buds, or more often, by fruiting specimens only. Additional collections with more complete specimens in flower are needed before these can be studied to advantage.

This study is to a considerable degree based on the specimens available in the herbarium of the Arnold Arboretum, and, unless otherwise stated the cited specimens will be found here. I was fortunately able to examine many of the historical specimens at Leiden, Utrecht, and Kew, in August 1950, but in a number of cases the actual types could not be matched with later collected material. This involves several of Miquel's species based on fruiting specimens or those with immature flowers. I have also examined the material in the Gray herbarium, and was able to borrow certain specimens from the U. S. National Herbarium where Philippine species were involved which were not represented here. Doctor R. Pichi Sermolli, Director of the Instituto Botanico, Florence, Italy, kindly loaned

[2] **Merrill, E. D.** Plant Life of the Pacific World. I-XV. 1–295: *fig. 1–255*. 1945 (p. 216. *fig. 255*).

me the master set of the important *Beccari* collections made in Borneo, Sumatra, Java, and New Guinea some 75 years ago which proved to be of very great importance because of the presence of numerous type collections. Finally, I am under great obligations to Dr. H. Lam, Director of the Rijksherbarium, Leiden for special material supplied in the form of duplicate specimens, and both to him and to Mr. H. K. Airy Shaw for their patience in rechecking the characters on certain important specimens where, for one reason or another, my hurriedly prepared notes proved to be inadequate as certain essential data on which I had depended had not been included in the original published descriptions.

PHILIPPINE SPECIES AND NEW RECORDS

Elaeocarpus argenteus Merr. Govt. Lab. Publ. **29:** 26. 1905, Enum. 3: 14. 1923.

Elaeocarpus merrillii Elm. ex Merr. Enum. l.c., *nom.* in syn.; Elm. Leafl. Philip. Bot. **10:** 3279. 1939, *descr.* anglice.

The type of Elmer's species is his *17133*, a fruiting specimen from Mount Bulusan, Sorsogon Province, Luzon, which was correctly reduced in 1923, as it cannot be distinguished from *E. argenteus* Merr. The species occurs on many of the higher mountains from northern to southern Luzon and Mindoro. Previously uncited collections are *Elmer 7422, 7745, 9324, 17631, 18269, Loher 14371, 14466, F. B. 25132 Leano, B. S. 27844 Ocampo, 48378 Ramos & Edano, P. N. H. 2832 Convocar, 8404 Sulit, 9551 Navarro.*

A Philippine endemic.

Elaeocarpus dinagatensis sp. nov. § *Ganitrus.*

Arbor, ramulis ultimis teretibus, circiter 8 mm. diametro, densissime breviter cinereo-pubescentibus, infra foliis cicatricibus perspicuis notatis; foliis firmiter chartaceis vel subcoriaceis, ellipticis vel oblongo-obovato-ellipticis, 14–33 cm. longis, 6–13 cm. latis, apice plerumque late rotundatis vel late brevissime acuminatis, deorsum plus minusve angustatis, basi subrotundatis vel obtusis, supra (costa excepta) glabris, nitidis, ad costam dense breviter pubescentibus, subtus paullo pallidioribus; nervis primariis utrinque circiter 12, perspicuis, elevatis, cum costam dense breviter cinereo-pubescentibus, reticulis consperse pubescentibus; marginibus subintegris vel irregulariter serrulatis, dentibus inter se 5–20 mm. distantibus et in foliis junioribus breviter barbatis, vetustioribus glabris; petiolo dense cinereo-pubescenti, 1.5–4 cm. longo; racemis (sub fructu) lateralibus, solitariis, in axillis defoliatis, ad 13 cm. longis, breviter cinereo-pubescentibus, pedicellis ad 1.5 cm. longis; fructibus maturis globosis, glaberrimis, 2 cm. diametro, endocarpio osseo, crassissimo, seminibus maturis 1 vel 2, sed ovario 5-loculari.

DINAGAT and BUCAS GRANDE ISLANDS: *Bur. Sci. 35117* (TYPE), *35214 Ramos and Pascasio*, May and June, 1919.

The specimens were named and distributed in 1919 or 1920, but no description was then published in the hope that future collections, with

flowers, might be received. It has been placed with confidence in the section *Ganitrus,* one of the characters of that group being its 5-celled ovaries. However, only two of the cells in the mature fruits bear seeds, although in cross section there are faint traces of three aborted cells. Among the Philippine species of this section the present one is distinguished by its rather large leaves which are distinctly pubescent beneath, its densely cinereous-pubescent branchlets and petioles, and its globose glabrous fruits.

Elaeocarpus floribundus Blume, Bijdr. 120. 1825; Koord. & Val. Meded. Lands Plant. **11:** 256. 1894 (Bijdr. **1:** 256), Atlas Baumart. Java 3: *pl. 424.* 1914.

Cordia dubiosa Blume, Bijdr. 844. 1826: Miq. Fl. Ind. Bat. **2:** 915. 1858; Hallier f. Meded. Rijks Herb. **36:** 3. 1918.

Elaeocarpus ramosii Knuth, Repert. Sp. Nov. **44:** 131. 1938, *syn. nov.*

PALAWAN: Taytay, *Merrill 9260, 9393;* Aborlan, *P. N. H. 6650, 12517 Sulit,* May, 1940, and May, 1950, in forests at low altitudes.

The type of collection *Elaeocarpus ramosii* Knuth was *Ramos 1227* from the neighborhood of Sandakan, British North Borneo. I am unable to distinguish good specimens of this collection, and the Palawan collections cited above, from Blume's species, the type of which I have seen. We have a large series of specimens from Java, Sumatra, Borneo, the Malay Peninsula and Indo-China, all of which were identified as representing Blume's species, and I believe correctly so. The species has previously been credited to the Philippines on the basis of *Ahern 403* from Surigao, Mindanao, I having identified it as Blume's species at Buitenzorg, in 1902. But the fruits of this number are very narrow, elongated, fusiform, 2.5–4 cm. long and at most 1 cm. in diameter; if this collection represents Blume's species, then it is very aberrant in its fruit characters. The leaves of *E. floribundus* Blume are characteristically pustulate when dry, and are also seemingly glandular punctate beneath; Adelbert's note, Blumea 6: 311. 1947, should be consulted, as he observed that these swellings or pustules are filled with small lumps of minute crystals. I checked on Hallier's reduction of *Cordia dubiosa* Blume, and can only agree with him, but the expression "calyce fructigero tubuloso striato" must be excluded. Otherwise Blume's short description, and Miquel's amplified one, which was based on the same specimen, applies definitely to *Elaeocarpus floribundus* Blume; the specimen was sterile when Miquel studied it. It is suspected that Blume might have had detached fragments of a *Cordia* which later became lost, and that he realized that the vegetative characters of his new species were remote from the other *Cordia* species, this probably explaining his selection of the specific name *dubiosa.*

Elaeocarpus gammillii Knuth, Repert. Sp. Nov. **50:** 83. 1941.

GUIMARAS: *Gammill 319, 300* (type number), February, 1904, both specimens with very young flower buds.

It was realized many years ago that these two Gammill collections rep-

resented a species distinct from all other known ones, but in the absence of mature flowers and fruits no description was prepared in the hope that the same species would show up in other collections. I have seen nothing like this species in the extensive series of Philippine, Malaysian, and Papuasian species studied, and this includes a very high percentage of all extant types. A collection was sent to Guimaras in February 1950 with the hope that he might secure specimens with mature flowers, but unsettled conditions made it impossible for him to prosecute field work at that time. I do not know the proper alliance of the species. The cited specimens are in the U. S. National Herbarium.

Elaeocarpus gigantifolius Elm. Leafl. Philip. Bot. 4: 1182. 1911; Merr. Enum. 3: 17. 1923.

The type of this was *Elmer 11184* from Mount Apo, Mindanao. To the species I now refer *Zwickey 759* from Lanao Province, Mindanao, *Ebalo 954* from Basilan, *Wenzel 616, 1084* from Leyte, one of these distributed as *E. leytensis* Merr. with which it has nothing to do, and still another Leyte collection in the Arboretum herbarium *B.S. 41789 Edano;* but it is suspected that here a mixed label is involved, as its label bears the name *Psychotria banahaensis* Elm. The leaves of these Leyte collections are smaller than are those of any specimen of *Elmer 11184* that I have seen, but Mr. Elmer states regarding his species that the leaves were 9- to 13-nerved and 30 × 20 cm. "occasionally much smaller or much larger." As his material was taken from a single tree, the quoted observation illustrates one of the difficulties that herbarium workers encounter in the large leaved species in such a protean genus as *Elaeocarpus*. Generally speaking field notes are wanting, or very short, and no single herbarium sheet of the large-leaved species will show all the variations in size. The specimens cited all suggest that the alliance of this species is with the much smaller leaved *E. glaber* Blume (Mindanao, Borneo, Java, Sumatra), the leaves of which have fewer nerves, and with the large leaved Bornean *E. atrescens* Knuth; but the latter has subferruginous-pubescent racemes and globose fruits.

Elaeocarpus glaber Blume, Bijdr. 122. 1825; Koord. & Val. Meded. Lands Plant. 33: 416. 1900 (Bijdr. Boomsoort. Java 5: 416), Atlas Baumart Java 3: *pl. 427*. 1914.

MINDANAO: Zamboanga Province, Sax River, *Williams 2134,* February, 1905, a fruiting specimen, U. S. National Herbarium, Gray Herbarium, New York Botanical Garden.

This single collection, as far as I can determine from a fruiting specimen, seems to represent Blume's species which was based on Java material which I have seen. It also occurs in Sumatra and in Borneo. It is possible that when Mindanao flowering specimens are available, characters may be found by which the Philippine form may be distinguished. For the present I accept this identification and thus add another species to the Philippine list. Blume's species is well represented in the Arnold

Arboretum herbarium by specimens in flower and in fruit from Java, Sumatra, and Borneo.

Elaeocarpus halconensis Merr. Philip. Jour. Sci. **26**: 470. 1925.

An endemic species known only from the type collection, *B. S. 40583 Ramos & Edano,* from Mount Halcon, Mindoro.

Elaeocarpus knuthii sp. nov. § *Dicera.*

Arbor, ut videtur parva, novellis racemisque plus minusve pubescentibus exceptis glabra vel subglabra, ramis teretibus, ramulis ultimis circiter 1 mm. diametro, glaberrimis; foliis late oblongo-lanceolatis vel subellipticis, 5–9 cm. longis, 2–4 cm. latis, graciliter acuminatis, basi acutis, coriaceis, subintegris vel obscure crenulatis, crenulis breviter atro-apiculatis, subtus saepe plus minusve punctato-glandulosis; nervis primariis utrinque 6–8, subtus distinctis, arcuato-anastomosantibus, utrinque subdense reticulatis, venulis ultimis plus minusve elevatis; petiolo glabro, 1–2 cm. longo; racemis axillaribus, solitariis, paucifloris, 1.5–3 cm. longis, junioribus dense pallide adpresse pubescentibus, maturis leviter pubescentibus sub fructu glabris; floribus 4-meris, pedicellis adpresse pubescentibus glabrescentibus, 3–4 mm. longis; sepalis oblongis, circiter 5 mm. longis et 1.6 mm. latis, extus leviter adpresse pubescentibus, intus glabris, sursum angustatis, acutis vel subacutis; petalis sepalis aequantibus, oblongis vel oblongo-oblanceolatis, circiter 1.8 mm. latis, deorsum angustatis, apice ambitu rotundato-truncatis, segmentis 10–12, brevissimis, vix 0.5 mm. longis, extus adpresse pubescentibus, pilis pallide brunneis, nitidis, intus leviter pubescentibus; staminibus circiter 12, filamentis 1–1.3 mm. longis; antheris ad 2 mm. longis, linearibus, loculis obtusis nec aristatis nec penicillatis; ovario anguste ovoideo, dense subadpresse nitide pubescenti, 2-loculari, loculis 2-seriatim 4-ovulatis; fructibus pallidis, nitidis, glabris, ellipsoideis, circiter 8 mm. longis et 6 mm. diametro, endocarpio anguste ovoideo, sursum leviter angustato, leviter rugoso, 1-loculari, circiter 7 × 4 mm.

BRITISH NORTH BORNEO: Mount Kinabalu, Tenompok, Penibukan, Marai Parai Spur, and Colombon River, *Clemens 28626, 29261* (TYPE) *29323, 29935, 32130, 32227, 32431, 32993, 33990,* alt. 1200 to 1800 m. at various dates in 1931, 1932, and 1933, two of the numbers in full flower in mid-April. There are no notes as to the size and habitat on any of the labels.

This species in some characters suggests *Elaeocarpus fulvotomentosus* Knuth, a species also common on Mount Kinabalu but actually belonging in a different group. That species differs from the present one notably in its conspicuous indumentum, larger leaves, and different floral details. From the number of collections made, and the separate localities indicated, this is probably one of the most common species of the genus on Mount Kinabalu. Named in honor of Dr. R. Knuth.

Elaeocarpus lagunensis Knuth, Repert. Sp. Nov. 50: 85. 1941 § *Dicera.*

Elacocarpus sessilis Knuth, op. cit. 87, *syn. nov.*

The type of *E. lagunensis* Knuth was a fruiting specimen, from San Antonio, Laguna Province, Luzon, *B. S. 15126 Ramos,* and that of *E. sessilis* Knuth, was also a fruiting specimen from Mindoro, *F. B. 11484 Merritt.* After a critical comparison of duplicate specimens, of these two collections in the U. S. National Herbarium, I fail to find a single character by which two species may be distinguished. In reducing *E. sessilis* Knuth to synonymy I accept Knuth's other specific name *lagunensis* because the additional floral characters given below were taken from a specimen from its type locality.

Flowers numerous, the somewhat pubescent slender pedicels up to 9 mm. long. Sepals glabrous externally, oblong to oblong-elliptic, acute or obtuse, 6 mm. long, 2–2.5 mm. wide, inside keeled and somewhat pubescent. Petals as long as the sepals, membranaceous, about 2.8 mm. wide near the apex, narrowed from near the tip to the base, glabrous, with 3 short, oblong or oblong-ovate, at most 1.5 mm. long, entire or obscurely retuse lobes. Stamens about 25, from the densely pubescent torus, the filaments slender, glabrous, anthers narrowly oblong, 1.5 to 1.7 mm. long, very obscurely pubescent, obtuse or acute, neither awned nor penicillate. Ovary narrowly ovoid, glabrous, the style up to 3 mm. long.

The following additional collections represent the species: LUZON: Laguna Province, San Antonio, *Merrill Phil. Pl. 1110,* erroneously distributed as *E. gitingensis* Elm., a totally different species; Isabela Province, Mount Moises, *B. S. 47339 Ramos & Edano,* in fruit. CATANDUANES: *B. S. 30217 Ramos,* in fruit, these distributed as representing the allied but different *E. verticillatus* Elm.

Elaeocarpus merrittii Merr. Philip. Jour. Sci. Bot. **2**: 280. 1907, Enum. **3**: 17. 1923.

Elaeocarpus bellus Knuth, Repert. Sp. Nov. **49**: 67. 1940, *syn. nov.*

It is rather curious that Knuth in describing *Elaeocarpus bellus* in 1940 cited *Merrill 5582* from Mount Halcon, Mindoro, as its indicated type, but failed to note that this number is also the indicated type of *Elaeocarpua merrittii* Merr. of 1907. I suspect that he was misled by seeing a specimen of *Merrill 5727,* from the same locality, which is *E. pendulus* Merr. and which was so recorded by me in 1907; unfortunately, the duplicates were distributed as *E. merrittii* Merr. Apparently he did not check on the original description.

Available to me at the present time are the following collections representing this species: LUZON: Mountain Province (Lepanto), *F. B. 14437 Darling:* Nueva Vizcaya Province, Mount Alzapan, *B. S. 45617 Ramos & Edano:* Rizal Province, *Loher 15101:* Tayabas Province, Mount Camatis, *P. N. H. 4478 Alcasid & Edano:* Mount Binuang, *B. S. 28474 Ramos & Edano.* MINDORO: Mount Halcon, *Merrill 5582,* type collection of both *Elaeocarpus merrittii* Merr. (1907) and *E. bellus* Knuth (1940). This is much the same as my indicated distribution of this Philippine endemic as of 1923; a species of the higher mountains ranging from northern to central Luzon and Mindoro.

Elaeocarpus mindorensis Knuth, Repert. Sp. Nov. 50: 86. 1941.

The type and only known collection is *B. S. 39814 Ramos* from Paluan, Mindoro; the flowers are unknown. I fail to match this with any other described Malaysian or Philippine species. Its alliance I judge to be with *E. foxworthyi* Merr. of Palawan.

Elaeocarpus multiflorus (Turcz.) F.-Vill. Novis. App. Fl. Filip. 31. 1880; Merr. Enum. 3: 18. 1923.

Elaeocarpus leytensis Merr. Philip. Jour. Sci. 8: Bot. 383. 1913, Enum. 3: 17. 1923, syn. nov.

Wenzel 212, type of *E. leytensis* Merr. cannot, I believe, be distinguished from *Cuming 873*, type of *Monocera multiflora* Turcz., which was from Albay Province, Luzon. *Elmer 16022* from Sarsogon Province, Luzon, belongs here, having been erroneously distributed as *E. gitingensis* Elm. Previously uncited collections are *P. N. H. 2732 Sulit* from Sorsogon, *P. N. H. 5699 Castro* from Samar, and *B. S. 43278 Ramos*, from Bohol. In recent years this species has also been found in the Talaud Islands between Mindanao and Celebes.

Elaeocarpus octopetalus Merr. Philip. Jour. Sci. 3: Bot. 149. 1908, Enum. 3: 18. 1923, *emend.*, petalis sepalisque 4, non 8.

It seems to be apparent that there was a grave error in the original description where I stated that there were 8 sepals and 8 petals and stressed this point by proposing a new section *Octelaeocarpus*. Unfortunately the holotype (*Clemens 1148*, from Lake Lanao, Mindanao) was destroyed in Manila and there are apparently no extant isotypes, as search at Leiden, at Kew, and at the United States National Herbarium failed to locate specimens. However, in the latter herbarium is one poor specimen with buds, collected by Mrs. Clemens at the type locality (and possibly from the type tree), unnumbered, but named and distributed by me as representing this species. The buds have but 4 sepals and 4 petals. A recent collection, in flower, that matches this is *P. N. H. 6325 Sulit* from the vicinity of Concord, Samar at 230 m. alt., in dipterocarp forests. It is perhaps regrettable when we have to consider such an inappropriate name as "octopetalus" for a species the flowers of which have but 4 petals, that there is no way by which the inappropriate name may be discarded. The species belongs in the section *Monocera* or in Schlechter's arrangement in his section *Coilopetalum*, apparently in the alliance with *E. paniculatus* Wall. and *E. griffithii* (Wight) A. Gray, but I have failed in an attempt to reduce it to any other described species.

Elaeocarpus palimlimensis Knuth, Repert. Sp. Nov. 49: 68. 1940.

LUZON: Ilocos Norte Province, Mount Palimlim, *B. S. 33377 Ramos*, August, 1918.

A species known only from a fruiting specimen, distinct from all other described ones. I can only add that the fruiting racemes are in the upper axils, not terminal, that the 5-celled ovaries usually develop into 3-celled fruits, that the bony endocarp is characteristically lamellate, and that it belongs in the *Ganitrus* group.

Elaeocarpus parvilimbus sp. nov. § *Dicera.*

Arbor parva, inflorescentiis exceptis glabra, ramis ramulisque numerosis, teretibus, ultimis circiter 1 mm. diametro; foliis inter minores, numerosis, coriaceis, opacis, supra olivaceis, subtus pallidioribus, in ramulis ultimis plus minusve confertis, ellipticis vel subellipticis, 2–3.5 cm. longis, 1–1.5 cm. latis, obtusis vel rotundatis, utrinque subaequaliter angustatis, basi acutis, marginibus deorsum integris, sursum crenulatis, crenulis inter se 1.5–3 mm. distantibus, minute apiculatis; nervis primariis utrinque 4–6, in axillis haud glandulosis, utrinque cum reticulis elevatis et distinctis; petiolo glabro, 4–5 mm. longo; racemis solitariis, in axillis superioribus, quam foliis longioribus, 5–6 cm. longis, pedunculatis, paucifloris, rhachibus plus minusve adpresse pubescentibus vel subglabris; pedicellis adpresse cinereo-pubescentibus, 5–8 mm. longis; floribus circiter 5 mm. longis, 4–5-meris; sepalis lanceolatis vel oblongo-lanceolatis, acutis vel leviter acuminatis, extus subconsperse vel subdense adpresse cinereo-pubescentibus, intus glabris; petalis 5 mm. longis, utrinque in partibus dimidiatis inferioribus adpresse pubescentibus, sursum glabris, laciniis 6–8, gracilibus, 1.1–2 mm. longis; staminibus circiter 20, filamentis 1 mm. longis, leviter pubescentibus; antheris 1.2–1.8 mm. longis, obscure breviter pubescentibus, haud aristatis vel barbatis, locellis obtusis; ovario dense adpresse pubescenti, 2-loculari; stylo leviter pubescenti, 3 mm. longo.

LUZON: Rizal Province, Mount Lumutan, *B. S. 42239 Ramos*, April, 1923 (TYPE), in the mossy forest, altitude about 1200 m.; Tayabas Province, Mount Camatis, *P. N. H. 8022 Celestino*, May 29, 1948, mossy forest, altitude about 2000 m.

MINDANAO: Surigao Province, Mount Kabatuan, *P. N. H. 10567 Mendoza & Convocar*, alt. 770 m.

This is another species of which the type collection was named and distributed in 1923 but not hitherto described. Among the relatively few small leaved Philippine species it is distinguished by its vegetative characters, its more or less fastigiate branchlets, and its small flowers. Its general alliance is with *E. argenteus* Merr.

Elaeocarpus pedunculatus Wall. List no. 2678. 1832, *nom.*, et ex Mast. in Hook. f. Fl. Brit. Ind. 1: 408. 1874, *descr.*

Elaeocarpus matangensis Knuth, Repert. Sp. Nov. **44:** 130. 1938, *syn. nov.*
Elaeocarpus nitidulus Knuth, op. cit. **49:** 67. 1940, *syn. nov.*

The type of *E. matangensis* Knuth was *Clemens 22303* from Mount Matang, Sarawak, and while that entity may be separated from typical *E. pedunculatus* Wall. by what I consider to be very minor characters, I feel that its proper place is in the synonymy of Wallich's species. Likewise, I reduce *E. nitidulus* Knuth, for this impresses me as even less distinct from Wallich's species than is the Bornean form above reduced; its type was *B. S. 42134 Ramos* from Busuanga, originally distributed as *E. candollei* Elm., from which it is very distinct. I refer the following Philippine collections to Wallich's species: CULION: near the leper colony, *Bartlett 15565*, July, 1935. PALAWAN: Aborlan River, *P. N. H.*

6677 Sulit, May, 1940. LUZON: Camarines Province, *B. S. 33696 Ramos & Edano,* in fruit, Nov.-Dec., 1918. PANAY: *F. B. 25365 Achacosa,* April, 1916. There are in the Arnold Arboretum herbarium about 15 individual collections from the Malay Peninsula and Borneo that I unhesitatingly refer to *E. pedunculatus* Wall. Furthermore, I refer here the specimens, but not the cited names, distributed by Hochreutiner as *E. miquelii* Hochr. in his Pl. Bogor Exsic. no. 50, which were apparently taken from the planted specimen (VI. 6. 195) in the Buitenzorg Botanical Garden. However, *E. miquelii* Hochr. *was published as a new name for Monoceras robustum* Miq. (non *Elaeocarpus robusta* Roxb.) and I place these as synonyms of the very different *Elaeocarpus obtusus* Blume. The known range, as I interpret Wallich's species, is various parts of the Malay Peninsula, Sumatra, Bangka, Billiton, Java (planted), Borneo, and in the Philippines, Palawan, Busuanga, Culion (a very natural range for many species of the Sunda Islands), Panay, and southern Luzon.

Elaeocarpus procerus Aug. DC. Leafl. Philip. Bot. 2: 636. 1909; Merr. Enum. 3: 19. 1923.

Elaeocarpus fusicarpus Elm. op. cit. 4: 1174. 1911; Merr. op. cit. 16.

The type of *E. procerus* Aug. DC. was *Elmer 10158* from Negros. *Elaeocarpus fusicarpus* Elm., was, I believe, correctly reduced by Airy-Shaw in 1949; it was based on *Elmer 10819, 10828, 11769* from Mount Apo, Mindanao. More recent collections from Mount Halcon, Mindoro are *B. S. 40672 Ramos & Edano* and *P. N. H. 3333, 3499 Edano.* All of these cited collections are in the Arnold Arboretum Herbarium.

Elaeocarpus trichopetalus Merrill & Quisumbing, sp. nov. § *Ganitrus.*

Species *E. sphaerocarpo* (Gaertn.) K. Schum, simillimis et affinis, differt petalis utrinque perspicue adpresse pubescentibus, intus pilis retrorsis, stylo longe exserto, subtus foliis in axillis primariis secundariisque barbato-glandulosis. Arbor circiter 18 m. alta, ramis teretibus, glabris, ramulis ultimis breviter adpresse subcinereo-pubescentibus glabrescentibus, 2–3 mm. diametro; foliis numerosis in ramulis ultimis plus minusve confertis sed haud verticillatis, oblongis, chartaceis, 8–12 cm. longis, 3–4 cm. latis, subolivaceis, supra nitidis, glabris, subtus paullo pallidioribus, consperse subpunctato-glandulosis et in axillis primariis secundariisque distincte barbato-glandulosis, basi leviter decurrento-acuminatis, apice acutis vel subobtusis, vix acuminatis, margine crenulato-dentatis, dentibus parvis, distincte apiculatis; nervis primariis utrinque 10–12, tenuibus; petiolo obscure pubescenti, ca. 1 cm. longo; racemis brevibus, 3–5 cm. longis, infra foliis in axillis defoliatis, subcinereo-pubescentibus, 12–20-floris, solitariis, patulis; floribus 5-meris, circiter 1.2 cm. longis; pedicellis breviter pubescentibus, 10–12 mm. longis; sepalis oblongis vel oblongo-lanceolatis, acutis vel subobtusis, sursum plus minusve angustatis, extus breviter adpresse pubescentibus, 9 mm. longis, 2 mm. latis; petalis circiter 12 mm. longis et 4 mm. latis, deorsum angustatis, utrinque pubescentibus, extus dense adpresse subcinereo-villosis, intus dense

villosis, pilis valde retrorsis, dimidio superiore ca. 10-fidis, segmentis gracilibus, extus deorsum plus minusve villosis, sursum subfiliformibus, glabris; staminibus circiter 30, 5–6 mm. longis, filamentis obscure pubescentibus, 1–1.5 mm. longis; antheris linearibus, minute pubescentibus, haud aristatis, obscure penicillatis; ovario ovoideo, dense breviter adpresse pubescenti, 5-loculari, loculis biseriatim 4–5-ovulatis; stylis longe exsertis, rectis, circiter 1.5 cm. longis, adpresse pubescentibus vel sursum glabrescentibus; fructibus immaturis sub-obovoideis, obscure pubescentibus glabrescentibus, circiter 1.5 cm. longis et 1.3 cm. diametro, rotundatis abortu 1-locularibus.

MINDANAO: Bukidnon Province, Mount Katanglad, *P. N. H. 10099 Sulit*, March 25, 1949, in dense mossy forests at 1850 m. alt.

This species among its congeners (*Elaeocarpus sphaericus* K. Schum. and allies) is distinguished by its petals being conspicuously pubescent in both surfaces, the hairs on the inner surface strikingly retrorse, and from most described species in the group by its long exserted styles, while the axils on the lower surfaces of the leaves are glandular and bearded. In general aspect it is otherwise very similar to the collective *Elaeocarpus sphaericus* (Gaertn.) K. Schum. and to other described forms in this close alliance; but all of the associated species that I know have nearly glabrous petals except those of *E. dolichopetalus* Merr. The one fruit that I have seen, and the only one collected, is immature, the seed not formed, by abortion 1-celled as in most other species in this group. Its alliance is clearly with *E. dolichopetalus* Merr.

Perhaps too many species have been characterized in this *E. sphaerocarpus* (Gaertn.) K. Schum. (*E. ganitrus* Roxb.) complex and Corner and Van Steenis may be correct in treating the species as a collective one. But if Corner be correct in reducing the Philippine *E. subglobosus* Merr., and Van Steenis be correct in following my reduction of *E. baclayanensis* Elm., then others such as *E. amboinensis* Merr., *E. maior* (Hochr.) Knuth, *E. dolichopetalus* Merr., *E. ramiflorus* Merr., and *E. wenzelii* Merr. should be considered. But even if all or most of these be finally reduced to the synonymy of the collective *E. sphaericus* (Gaertn.) K. Schum. still *E. trichopetalus* is distinguishable by so many characters that we feel entirely justified in naming and characterizing it.

Elaeocarpus triflorus sp. nov. § *Dicera*.

Arbor glabra, ramis ramulisque teretibus, ramulis ultimis gracilibus, circiter 1 mm. diametro; foliis numerosis, in ramulis ultimis confertis pseudoverticillatim dispositis, breviter (2–4 mm.) petiolatis, anguste oblongo-obovatis vel late oblanceolatis, subcoriaceis, plerumque olivaceis, 4–7 cm. longis, 1.5–2.5 cm. latis, breviter obtuse acuminatis, basi cuneatis, margine sursum distanter crenato-serrulatis, dentibus apiculatis, plerumque utrinque 3 vel 4, deorsum integris; nervis primariis utrinque circiter 6, haud perspicuis, subadscendentibus, subtus in axillis aliquando glandulosis; racemis paucis, brevibus, glabris, in axillis superioribus, 2.5–3 cm. longis, 3- vel 2-floris; floribus 4-meris, pedicellis ad 12 mm.

longis; sepalis oblongo-ellipticis, apice rotundatis vel obtusis, 7 mm. longis, 3 mm. latis, extus obscurissime pubescentibus, intus leviter pubescentibus et infra medio carinatis; petalis obovatis, intus leviter pubescentibus, circiter 8 mm. longis et sursum 4 mm. latis, deorsum angustatis, basi 2 mm. latis, apice in ambitu subtruncatis, in lobis 5–6 primariis circiter 2 mm. longis divisis, secundariis circiter 14, 0.5–1· mm. longis; staminibus circiter 15, filamentis glabris, 2 mm. longis; antheris anguste oblongis, obtusis, ca. 2.5 mm. longis, haud penicillatis vel aristatis; ovario oblongo-ovoideo, glabro, circiter 2.5 mm. longo, 2-loculari; stylis 3.5 mm. longis, glabris, receptaculis dense pubescentibus; fructibus ellipsoideis, glabris, nitidis, pallidis levis, 1-locellatis, circiter 1.5 mm. longis.

LUZON: Tayabas Province, Guinayangan, *B. S. 20796* (TYPE), *20888 Escritor*, March-April, 1913, U. S. National Herbarium. Mount Dingalan, *B. S. 26559 Ramos & Edano*, Aug.-Sept. 1916 (in fruit).

The alliance of this species is clearly with that group of species with subverticillately crowded leaves at the tips of the slender young branchlets typified by *E. verticillatus* Elm. and containing also *E. lagunensis* Knuth (*E. sessilis* Knuth), and *E. halconensis* Merr. It is characterized, aside from its special petal characters, by its short, slender, 3- or 2-flowered racemes. Among the indicated allies it is apparently closest to *E. halconensis* Merr. which has much smaller entire leaves. One of the numbers cited was distributed as representing *E. verticillatus* Elm., but that species, as at present understood, is known only from the two original Sibuyan collections cited by Mr. Elmer.

Elaeocarpus urophyllus Merrill & Quisumbing sp. nov. § *Dicera*.

Arbor 7–8 m. alta, ramulis ultimis glabris (novellis dense adpresse subargenteo-pubescentibus), circiter 4 mm. diametro, brunneis; foliis longe (3–5 cm.) petiolatis, subellipticis, basi late acutis, apice longe (usque ad 2.5 cm.) caudato-acuminatis, subcoriaceis, 8–11 cm. longis, 3.5–4 cm. latis, marginibus crenulatis, crenulis inter se 2–4 mm. distantibus, minute atro-apiculatis, supra pallide viridibus, glaberrimis, subnitidis, subtus pallidioribus et minute adpresse plus minusve consperse argenteo-pubescentibus glabrescentibus, juvenilibus utrinque densissime adpresse nitido-pubescentibus; nervis primariis utrinque 7–9, supra planis vel subimpressis, subtus elevatis, valde perspicuis, curvato-adscendentibus, irregu'ariter arcuato-anastomosantibus, axillis primariis et secundariis domatiferis, secundariis barbatis (vel domatiis nullis); petiolo plus minusve adpresse pubescentibus, pilis mox deciduis; racemis (sub fructu) axillaribus et in axillis defoliatis, solitariis, foliis aequantibus, leviter adpresse pubescentibus, gracilibus; pedicellis adpresse pubescentibus, 1–1.2 cm. longis; ovario densissime adpresse argenteo-pubescenti; fructibus ellipsoideis, 1 cm. longis, 1-locellatis, in sicco pallidis, rugosis, junioribus consperse pubescentibus mox glabris.

SAMAR: Mount Calbiga, near Wright, *P. N. H. 6382 Sulit*, May 17, 1948, on forested ridges near kilometer 61, alt. about 300 m.

In spite of the fact that the flowers of this species are unknown (one mature ovary seen), and its fruits are not quite mature (full grown but seeds immature), its alliance is clearly with *Elaeocarpus merrittii* Merr. of which *E. bellus* Knuth, Repert, Sp. Nov. 49: 67. 1940 is an exact synonym. It is distinguished by its larger, more numerously nerved leaves.

Elaeocarpus verticillatus Elm. Leafl. Philip. Bot. 4: 1181. 1911; Merr. Enum. 3: 20. 1923, quoad *Elmer 12104, 12427* (Sibuyan).

Elaeocarpus verticillatus Elm. is now restricted to the two numbers from Sibuyan on which the original description was based. The other specimens cited by me represent *E. lagunensis* Knuth (*E. sessilis* Knuth), and *E. trianthus* Merr.

Elaeocarpus zambalensis Elmer, Leafl. Philip. Bot. 9: 3185. 1934, anglice. § *Dicera*.

Arbor, ramulis ultimis leviter pubescentibus, 1.5–2 mm. diametro; foliis numerosis, lanceolatis, olivaceis, subcoriaceis, basi cuneatis, sursum angustatis, longe acuminatis, vetustioribus glabris, junioribus praesertim subtus secus costam leviter pubescentibus, crenato-serratis, deorsum integris, 6–8 cm. longis, 1.5–2 cm. latis, nervis primariis utrinque 6–10 (4–7 fide auctore), curvato-adscendentibus, distinctis, gracilibus; racemis (haud spicis) axillaribus, cinereo-pubescentibus, foliis subaequantibus, pedicellis 4–5 mm. longis; floribus 5-meris, 5–6 mm. longis, (haud "1 cm." ut in descr. angl.), sepalis lanceolatis, acuminatis, extus breviter cinereo-pubescentibus; petalis 5–5.5 mm. longis (haud "1.25 cm." ut in descr. angl.) 1.7–2 mm. latis, extus dense deorsum adpresse subargenteo-villosis, graciliter fimbriatis, fimbrias circiter 10, 2.5–3 mm. longae; staminibus circiter 25, liberis, filamentis 1.2 mm. longis, pubescentibus; antheris oblongis, 2 mm. longis, locellis inaequalibus, altero obtuso, altero distincte aristato, aristis rectis vel curvatis, 0.5 mm. longis; ovario dense adpresse albido-villoso, 2-loculari.

LUZON: Pampanga Province, i.e., on the Pampanga side of Mount Pinatubo, *Elmer 21943*, May, 1927, alt. about 1200 m.

When the specimens of *Elmer 21943* were first examined my inclination was to refer them to *E. gitingensis* Elm. to which he compared it. He erred in describing the inflorescences as spicate, the stamens as forming a column 5 mm. long (unless he meant that they simulated a column, for they are entirely free), and particularly in giving the measurements as sepals 1 cm. long (they are only 5–6 mm. long), and the petals as 1.25 cm. long (they are not more than 6 mm. in length); such striking discrepancies are difficult to explain. One might suspect a possible mixture of material, but I do not think that this was the case, as all specimens of *Elmer 21943* that I have seen are uniform. The corrections have been made in the above diagnosis. In *E. gitingensis* Elm. the anther-cells are subequal, the slightly longer one not being at all awned, thus falling in *Dicera;* but *E. zambalensis* Elm. which is manifestly very closely allied, because one anther cell has a short awn it technically might be placed in

Monocera. This is a good illustration of the difficulties encountered in attempting, in this genus, to set up subdivisions, as the characters usually selected vary so much.

MALAYSIAN SPECIES

Elaeocarpus acmosepalus Ridl. Jour. Straits Br. Roy. As. Soc. 75: 8. 1917; Corner, Gard. Bull. Straits Settl. 10: 317. 1939.

Corner, who did not see Ridley's material, was puzzled regarding this species stating that if the description was correct that "it should be remarkably distinct in having only 3 pairs of lateral nerves to the leaf, and the long awns on the anthers tipped with hairs." Unfortunately in accepting a specific name originated by Stapf for a Bornean species, Ridley in 1917 applied it to a Malay Peninsula collection (Johore, *Cantley, s. n.*), based his descriptions largely on this, but cited the Bornean collections as named by Stapf. This Cantley specimen, the type at Kew, actually has 4 or 5 pairs of lateral nerves, not 3 as Ridley indicated. Mr. Airy Shaw of Kew believes that the species, as described by Ridley, must be interpreted by the Cantley specimen and that the binomial should be credited to him, not to Stapf. In this I agree because Stapf did not study or name the Cantley Johore specimen. The nerves on the Bornean specimens I have examined and which Ridley cited, vary from 6 to 10 pairs, and on *Beccari 3433*, the anthers are blunt, not awned. Mr. Airy Shaw states that the leaves of *Haviland 2035*, as to the number of nerves, are "more or less intermediate between those of *Beccari 3433* (*acmosepalus* Stapf) and the Peninsula and Sumatra material (*longifolius* var. *fusiformus* Corner and *submonoicus* Miq.)." He expressed the opinion that it would be very difficult to separate the three entities above listed, that *E. oxypyren* Koord. & Val. of Java must be closely allied, and that if these were united then Miquel's specific name would be the correct one to use.

Elaeocarpus acrantherus sp. nov. § *Monocera* (*Coilopetalum*).

Arbor petalis staminibusque exceptis glabra, ramulis ultimis glaberrimis, resinosis, haud incrassatis, 4–5 mm. diametro, teretibus; foliis coriaceis, glaberrimis, in sicco olivaceis vel atro-olivaceis, supra plus minusve nitidis, subtus paullo pallidioribus, haud glandulosis, 12–15 cm. longis, 6–8 cm. latis, ovatis vel elliptico-ovatis, basi rotundatis, sursum plus minusve angustatis, apice breviter obtuse acuminatis; nervis primariis utrinque circiter 7, subtus elevatis, inter se 1–2 cm. distantibus, curvatis, obscure anastomosantibus; petiolo 3–4 cm. longo; racemis axillaribus, solitariis, longe (ad 7 cm.) pedunculatis; floribus 8–10 in partibus ultimis (circiter 1 cm.) racemose dispositis; pedicellis ad 1.5 cm. longis; floribus 5-meris; sepalis coriaceis, utrinque glabris sed margine puberulis, oblongo-lanceolatis, intus carinatis, circiter 1 cm. longis et 3 mm. latis, sursum angustatis; petalis sepalis aequantibus, lanceolatis, sursum angustatis, ad 3 mm. latis, incrassatis, extus dense breviter adpresse subcinereo-pubescentibus, intus densissime retrorse hirsutis, partibus medianis longitudinaliter intumescentibus, apice in ambitu subacutis, circiter

10-fimbriatis, fimbriis 1–1.5 mm. longis; staminibus circiter 50, brevissime minute adpresse pubescentibus, filamentis 1.2–2 mm. longis, antheris linearibus, loculis 3 mm. longis, sursum in aristam rectam 2 mm. longam attenuatam; ovario ovoideo, cum stylo glabro, 2-loculari, ovulis 10–12, biseriatim dispositis.

BORNEO: Sarawak, *Beccari 1724*, in herb. Instituto Botanico, Florence.

Of this I have seen only a single sheet, the type collection, kindly loaned to me by Dr. R. Pichi Sermolli. The number cited is the one on the original Beccari label; on a supplementary label is the number 1899A, but this, I judge, was added by some other individual than the collector. I have not been able to associate this strongly marked species with any previously described one. It is entirely glabrous except for the strongly pubescent petals, the sepals being puberulent on their margins, and the stamens minutely appressed pubescent. Another striking character aside from the coriaceous and dark-olivaceous entire leaves is the long peduncled, axillary, solitary racemes, the flowers being more or less crowded along the upper 1 cm. of the axis, but neither capitate nor umbellate in arrangement; from this last character the specific name has been derived.

Elaeocarpus angustipes Knuth, Repert. Sp. Nov. 44: 124. 1938.

The type is *Clemens 29291* from Tenompok, Mount Kinabalu, British North Borneo; another collection, not previously cited, is *Clemens 29867* from the same locality.

Elaeocarpus atrescens Knuth, Repert. Sp. Nov. 44: 125. 1938.

The type number is *Clemens 32062* from Mount Kinabalu, British North Borneo. On one of the two sheets in the Arnold Arboretum set are immature, slender, subferruginous-pubescent racemes up to 13 cm. long, but the flower buds are too immature to add much to our knowledge of the species. Its alliances seem to be with the Philippine *E. gigantifolius* Elm., but in Elmer's species the fruits are ellipsoid rather than globose, while its racemes are apparently glabrous or nearly so.

Elaeocarpus beccarii Aug. DC. Bull. Herb. Boiss. II. 3: 367. 1903.

Elaeocarpus oxyadenius Warb. Repert. Sp. Nov. 18: 327. 1922.

The type of both *E. beccarii* Aug. DC. and the later *E. oxyadenius* Warb. was *Beccari 540* from Sarawak. There are various collections at Kew by *Haviland* and *Haviland and Hose*, and *Teysmann 8132, 11266*, in herb. Beccari, apparently belong here.

Elaeocarpus brachyandrus sp. nov. § *Fissipetalum*.

Arbor, inflorescentiis exceptis glabra, ramis haud incrassatis, teretibus, ramulis ultimis circiter 1.5 mm. diametro, novellis resinosis; foliis ellipticis, subcoriaceis, obscure crenulatis, crenulis inter se 3–7 mm. distantibus, minute apiculatis, tenuiter (ca. 1 cm.) acuminatis, basi late acutis, sicco pallide subviridis, subtus paullo pallidioribus; nervis primariis utrinque circiter 6, subtus elevatis, perspicuis, curvatis, laxe arcuato-reticulatis, axillis primariis domatiferis, reticulis ultimis distinctis, elevatis, subdensis;

petiolo 2–2.5 cm. longo, glabro; racemis in axillis superioribus et in axillis defoliatis, solitariis, circiter 6 cm. longis, plus minusve adpresse breviter cinereo-pubescentibus subglabrescentibus, 5–10-floris, pedicellis circiter 8 mm. longis; floribus 5-meris; sepalis lanceolatis, sursum angustatis, acutis vel acuminatis, extus leviter adpresse pubescentibus, intus glabris vel subglabris, obscure carinatis, 5.5 mm. longis, 1.8 mm. latis; petalis sepalis aequantibus, submembranaceis, circiter 3 mm. latis, marginibus subparallelis, subinvolutis, extus breviter adpresse pubescentibus, intus subvillosis, partibus medianis intumescentibus, sursum reticulatis, partibus ⅓ superioribus graciliter fimbriatis, fimbriis 10–12; staminibus circiter 20, brevibus, filamentis subincrassatis, glabris, 1 mm. longis; antheris vix 3 mm. longis, loculis minute scabridulis, 2 mm. longis, in setam rectam 1 mm. longam productis; ovario ovoideo, pubescenti, 3-loculari, loculis biseriatim 4-ovulatis; stylis adpresse pubescentibus, 4 mm. longis.

BORNEO: Sarawak, without definite locality, *Beccari 3498* in herb. Instituto Botanico, Florence.

This species clearly belongs in Schlechter's section *Fissipetalum*, but under the older system of classification might be placed in *Dicera* or, because of the distinctly awned anthers, in *Monocera*. In spite of the presence of the anther-awn its allies would probably be found in *Dicera;* the anther-cells are not penicillate. The petals are much thinner than the sepals and their more or less involute margins are roughly parallel. The glabrous, rather sharply acuminate leaves, the main axils beneath distinctly domatiferous, and the close, distinct, elevated ultimate reticulations on the lower surface are characteristic.

Elaeocarpus brevipes Merr. Jour. Straits Br. Roy. As. Soc. 86: 327. 1922.

Elaeocarpus baramensis Knuth, Repert. Sp. Nov. 44: 126. 1938.
Elaeocarpus rejangensis Knuth, op. cit. 141.

This Bornean species is represented by many collections, the two proposed by Knuth having been reduced by Airy Shaw in 1949, in which reduction I concur; no less than 17 individual collections are represented in the Arnold Arboretum Herbarium. Ridley, Kew Bull. 1938: 233. 1938, placed *E. brevipes* Merr. as a synonym of *E. stipularis* Blume, but Airy Shaw did not accept this reduction, nor can I do so at this time.

Elaeocarpus canipes Knuth, Repert. Sp. Nov. 44: 127. 1938.

Elaeocarpus molloides Knuth, op. cit. 49: 71. 1940, *syn. nov.*

The type of *E. canipes* Knuth was *Clemens 32039* from Penibukan, Mount Kinabalu, alt. 4000–5000 ft., and that of *E. molloides* Knuth, from the same locality and altitude, and I strongly suspect from the same tree. At any rate a single species is represented; the flowers are as yet unknown.

Elaeocarpus brunnescens Knuth, Repert. Sp. Nov. 44: 127. 1938.
§ *Ganitrus*.

Knuth's type, *Clemens 27273*, from Dallas, Mount Kinabalu, altitude

about 900 m., was a very poor specimen with a few immature buds, and the duplicate that is before me is a similarly poor specimen; his description is very inadequate. The same species is represented by *Clemens 26821*, a fruiting specimen from the same locality and same altitude; I suspect that both numbers were actually taken from the same tree. The fruits are globose, smooth, glabrous, 2 cm. in diameter, the bony endocarp 5-celled but only two of the cells developing seeds. In vegetative characters it can scarcely be distinguished from *Elaeocarpus nitens* Knuth, type *Clemens 20195* from Mount Poi, Sarawak, but the indumentum on the sepals of the two species is very different.

Elaeocarpus chrysophyllus Merr. Jour. Straits Br. Roy. As. Soc. 77: 199. 1917.

This species was based on *Native collector 1965* (*B. S.*) from Sarawak. The same species is represented by *Beccari 3099*, which had been indicated by Stapf as a new species in the Kew Herbarium but unfortunately he never published a description.

Elaeocarpus clementis Merr. Jour. Straits Br. Roy. As. Soc. 77: 195. 1917.

Elaeocarpus clemensiae Knuth, Repert. Sp. Nov. **44**: 128. 1938, *syn. nov.*

The type of *E. clementis* Merr. was *Native collector 2766* (*B. S.*) from Baram, Sarawak; that of *E. clemensiae* Knuth was *Clemens 51312* from Bungal, Mount Kinabalu, alt. about 900 m. Other collections are *Clemens 11165, 1489, 1968*, type collections of *E. clementis* Merr. var. *chrysosericea* Airy Shaw, Kew Bull. **1949**: 163. 1949, which can scarcely be distinguished from the species I originally described.

Elaeocarpus congestifolius Knuth, Repert., Sp. Nov. **49**: 68. 1940.

Elaeocarpus sericeus Stapf, Trans. Linn. Soc. Bot. II. Bot. **4**: 137. 1894, non Baker (1883), *syn. nov.*

This Mount Kinabalu species is represented by *Haviland 1111*, Stapf's type, *Clemens 10702, 28905* (Knuth's type), *32635*, all representing a distinctly uniform species. Knuth did not realize that he was redescribing Stapf's species but he did establish a valid specific name which, because of the homonym rule, replaces the one Stapf proposed in 1894.

Elaeocarpus crenatus (Raf.) Merr. Jour. Arnold Arb. **29**: 212. 1948, excl. syn. *E. rumphii* Merr.

Ayparia crenata Raf. Sylva Tellur. 154. 1838.
Arbor rediviva, Eyparehu Rumph. Herb. Amb. **3**: 165. *pl. 104.* 1743.
Elaeocarpus moluccanus Scheff. Nat. Tijdschr. Nederl. Ind. **31**: 345. 1870, *syn. nov.*

The generic description of *Ayparia* Raf. was based solely on the cited Rumphian description and illustration. In 1917, in describing *E. rumphii* Merr., on the basis of actual Amboina specimens, I erroneously considered that what Rumphius described and illustrated was the species I then characterized. An attentive reconsideration of the Rumphian data indicates that what he originally described, from fruiting material, is not the

same form as the species, in flower, he described in the appendix on p. 166 and illustrated by *plate 104*. The fruit description on p. 165 is not that of any *Elaeocarpus* but apparently appertains to *Aceratium oppositifolium* DC. The flowering specimen described in the appendix, and the form Rumphius illustrated, is an *Elaeocarpus* which I believe represents *Elaeocarpus moluccanus* Scheff., type from Amboina, with the vernacular name *epreoe*. This is a cognate form of *ayparehu* (*eparehu, typarehu, tette palehu*) of Rumphius. For the flowering specimen illustrated the leaf measurements were given as 3 to 4 by 2 inches. One should not be misled by the 3 or 4 to 5 or 6, irregularly arranged, sharp protuberances on the leaf surfaces, as these represent galls.

Elaeocarpus cupreus Merr. Jour. Straits. Br. Roy. As. Soc. 77: 193. 1917.

Elaeocarpus ochraceus Stapf. ex Ridl. Kew Bull. **1938:** 230. 1938, non Ridl. (1916), *syn. nov.*

Elaeocarpus fagaceus Knuth, Repert. Sp. Nov. **44:** 128. 1938, *syn. nov.*

For this thrice named Sarawak species the types are *Native collector 1702 (B. S.), Clemens 20820* of which there is a specimen in the Kew Herbarium, and *Haviland 33, 1230.* A single species is represented.

Elaeocarpus dictyophlebius sp. nov. § *Dicera.*

Frutex glaber, ramis teretibus, laevis, ultimis haud incrassatis; foliis crasse coriaceis, ovatis vel late oblongo-ovatis, basi late rotundatis, sursum angustatis, distincte (1–1.5 cm.) acuminatis, 7–15 cm. longis, 3.5–7 cm. latis, marginibus cartilagineis, integris vel sursum obscurissime distanter crenulato-apiculatis, sicco utrinque pallide viridibus, subnitidis, utrinque subconcoloribus; nervis primariis utrinque 5–6, distantibus, curvatis, laxe arcuato-anastomosantibus, subtus elevatis, perspicuis, subtus pulchre reticulatis, nervis primariis secundariisque distincte elevatis; petiolo 1.5–2.5 cm. longo; racemis axillaribus, solitariis, paucifloris, circiter 8 cm. longis, pedicellis circiter 2 cm. longis, gracilibus; floribus plerumque 4-, rariter 5-meris; sepalis lanceolatis vel oblongo-lanceolatis, acutis, extus glaberrimis, acutis, 7 mm. longis, 2.5–3 mm. latis, marginibus puberulis, intus glabris vel sursum obscure puberulis, deorsum carinatis; petalis sepalis aequantibus, oblongis, circiter 3 mm. latis, deorsum leviter angustatis sed basi haud cuneatis, intus dense villosis, apice in ambitu subrotundatis, breviter graciliter fimbriatis ca. 12-fimbriatis, fimbriae 1.2–1.5 mm. longae; staminibus 8–10, filamentis glabris, 2 mm. longis; antheris linearibus, 3–3.5 mm. longis, acuminatis, nec aristatis nec penicillatis; ovario ovoideo, glabro, 2-loculari, loculis ut videtur 2-ovulatis; stylo glabro, 2 mm. longo.

BRITISH NORTH BORNEO: Mount Kinabalu, *Clemens 32818*, April 21–29, 1933, Marai Parai Spur, on a ridge above the Kintaki River, alt. about 1650 m.

In some respects this species suggests *Elaeocarpus angustipes* Knuth but it is apparently not very closely allied to that Mount Kinabalu species, a second collection of which is *Clemens 29876*, also from Tenompok. This

new species differs notably from that of Knuth in its broader, shorter petioled, differently nerved leaves, its very beautiful reticulations, the ultimate nervelets being usually free within the final reticulations, its slender elongated pedicels, its glabrous calyces, and its petals glabrous outside, not silvery villous as in Knuth's species. One anther cell is slightly longer than the other, but is neither aristate nor penicillate.

Elaeocarpus dolichobotrys Merr. Jour. Straits. Br. Roy. As. Soc. 77: 198. 1917.

Elaeocarpus augustus Knuth, Repert. Sp. Nov. **44:** 125. 1938, *syn. nov.*

A single strongly characterized species is represented here, the various collections being *Clemens 10048, 27317, 27654, 28278,* all from Mount Kinabalu, and all represented in the Arnold Arboretum herbarium. I judge that the very poorly prepared specimens that Knuth had misled him, for although he stated that there were but 11 or 12 pairs of lateral nerves my specimen of his second cited number has 17 pairs, and the leaves of the other numbers, all imperfect, upper parts missing, have at least 14 pairs of nerves.

Elaeocarpus domatiferus sp. nov. § *Dicera.*

Arbor, inflorescentiis exceptis glabra, ramis teretibus, ramulis ultimis glabris, circiter 1.3 mm. diametro; foliis ellipticis vel late oblongo-ellipticis, sicco utrinque pustulatis, olivaceis vel viridi-olivaceis, firmiter chartaceis vel subcoriaceis, 8–17 cm. longis, 5–9 cm. latis, basi rotundatis vel late acutis, apice rotundatis vel brevissime late acuminatis, marginibus distincte crenato-serratis, dentibus breviter apiculatis; nervis primariis utrinque circiter 10, in foliis parvis paucioribus, sicco plerumque verruculoso-pustulatis, subtus elevatis, perspicuis, arcuato-anastomosantibus, subtus in axillis primariis plerumque distincte domatiferis; petiolo 1.5–5 cm. longo; racemis axillaribus, solitariis, subadpresse pubescentibus, multifloris, ad 10 cm. longis, sub fructu ad 15 cm. longis, alabastris dense pubescentibus, pedicellis ad 8 mm. longis, sub fructu glabris et 2 cm. longis; floribus 5-meris; sepalis oblongo-lanceolatis, extus plus minusve pubescentibus, intus subglabris, marginibus puberulis, acutis, 5.2–6 mm. longis, 2 mm. latis, sursum angustatis; petalis sepalis aequantibus, sursum 2 mm. latis, deorsum plus minusve angustatis, extus glabris, marginibus leviter pubescentibus, intus plus minusve pubescentibus in partibus inferioribus, partibus superioribus (2 mm.) fimbriatis, fimbriis circiter 15, gracilibus, 1.5–2 mm. longis; staminibus circiter 12, filamentis glabris, 0.6–0.8 mm. longis; antheris oblongis, obtusis, glabris vel subglabris, loculis aequalibus, haud aristatis, uno breviter penicellatis; ovario ovoideo, dense pubescenti, 3-loculari, loculis 2-ovulatis; stylis 4 mm. longis, deorsum pubescentibus; fructibus anguste ellipsoideis, 1.5–1.8 cm. longis, 8 mm. diametro, obtusis vel subacutis, 1-locellatis, endocarpio osseo, rugoso.

BRITISH NORTH BORNEO: Mount Kinabalu, Nuntok, Colombon Basin and River, *Clemens 32678* (TYPE), *32996, 34460,* April, July, and August, 1933, alt. 1000–1600 m.

The pustulate leaves remind one, as to this character, of the very different *Elaeocarpus floribundus* Blume, although the two are not closely allied. The domatia, usually evident in the primary axils on the lower surfaces of the leaves, are glabrous and somewhat saccate. The little blisters are abundant on both surfaces of the leaves, when dry, and occur also on the midribs, and nerves on both surfaces, as well as on the petioles and on the rachises of the racemes. The anther cells are equal, obtuse, neither of them awned, but one cell bears a few short terminal hairs.

Elaeocarpus elliptifolius Merr. Jour. Straits Br. Roy. As. Soc. 77: 193. 1917.

Elaeocarpus dallasensis Knuth, Repert. Sp. Nov. **49:** 69. 1940, *syn. nov.*

The basic specimens, all from Mount Kinabalu, are *Clemens 10783* and *26231*. Additional collections are *Clemens 31448, 33947*. A single species is represented, the flowers still unknown.

Elaeocarpus euneurus Stapf ex Ridl. Kew Bull. **1938:** 234. 1938.

Elaeocarpus beccarii Warb. Repert. Sp. Nov. **18:** 328. 1922, non Aug. DC. (1903).

For this Sarawak species, Stapf's herbarium name was correctly published by Ridley to replace Warburg's illegitimate later homonym. The type of both is *Beccari 3093;* other collections from Sarawak are *Native collector 1903* (B. S.), and *Haviland 2126, 2129*.

Elaeocarpus fairchildii sp. nov. § *Monocera* (*Blepharoceras* Schltr.).

Arbor circiter 10 m. alta, novellis inflorescentiisque breviter subcinereo-pubescentibus exceptis glabra; ramulis ultimis incrassatis, circiter 1 cm. diametro; foliis magnis, ellipticis vel late oblongo-ellipticis, firmiter chartaceis vel subcoriaceis, sicco subolivaceo-viridibus, utrinque subconcoloribus, basi rotundatis, apice breviter late obtuseque acuminatis, 25 cm. longis et 12 cm. latis (majoribus ad 53 × 20 cm. fide collectore); nervis primariis utrinque circiter 16 (ad 20 in foliis majoribus fide collectore), inter se 1.5–2 cm. distantibus, axillis haud glandulosis, margine minute obscure subglanduloso-denticulatis, dentibus inter se 1–1.5 cm. distantibus; petiolo glabro, 6–8 cm. longo (in foliis majoribus ad 15 cm. fide collectore); racemis numerosis in axillis defoliatis in ramulis ultimis infra foliis dispositis, solitariis, breviter cinereo-pubescentibus, ad 22 cm. longis, patulis, circiter 25-floris; floribus 5-meris, circiter 2 cm. diametro; pedicellis 8–10 mm. longis, cinereo-pubescentibus; sepalis lanceolatis vel oblongo-lanceolatis, plus minusve acuminatis, extus breviter pubescentibus, ca. 9 mm. longis et 2.5 mm. latis; petalis roseis, sicco rubro-brunneis, glaberrimis, 11–12 mm. longis, 4–5 mm. latis, deorsum angustatis, intus ad basin leviter carinatis, pulchre fimbriatis, segmentis 16–20, angustis, 3–4 mm. longis, sursum fere filiformibus; staminibus circiter 30, glabris, filamentis 1–1.5 mm. longis; antheris anguste lineari-oblongis, 2.5–3 mm. longis, apice in setam glabram patulam vel curvatam 1.8 mm. longam producto; ovario dense adpresse albido-villoso, oblongo-ovoideo, sursum

angustato, 2-loculari, loculis biseriatim 8-ovulatis; stylo circiter 4 mm. longo, deorsum adpresse villoso, sursum glabro.

HALMAHERA: Loloda Bay, Labo River, in the northwestern part of the island, *David Fairchild 393*, June 4, 1940. A tree along the river at sea level, flowers rose-pink.

When I first saw an authentic specimen of *Elaeocarpus debruynii* O. C. Schmidt, of New Guinea, in the Rijksherbarium, Leiden, I at first thought this Halmahera collection might be referred to that species. However, there are too many points of difference for this new species has densely pubescent (not glabrous) ovaries, larger flowers, rose-pink rather than pale yellow petals, and one of the anther cells is always conspicuously awned. By the older classification schemes it falls in the section *Monocera*, and by Schlechter's arrangement of the New Guinea species, apparently in his *Blepharoceras*, although very different from the other species placed here.

Doctor Fairchild was so impressed by the beauty of the tree, when it was observed from the launch on which he was travelling up the Labo River, that he prepared copious notes. He specifically mentioned the large leaves, the largest one measured being 21 inches long and 8 inches wide, with 20 pairs of nerves, its petiole being 6 inches long, the rose-pink flowers, the tips of the slender petal segments being white. He saw but one tree noting that the odor of its flowers reminded him of the smell of *Phallus impudicus*. He further stated: "It is one of the handsomest flowering trees I have seen in the Dutch East Indies: it may prove to be a very desirable ornamental."

This is an excellent illustration of the manifest fact that many of the remote parts of the Malay Archipelago have not been intensively explored by botanists or botanical collectors, otherwise this spectacular species would not have escaped detection until this relatively late date in the history of botanical exploration. Halmahera is one of the islands that is very inadequately explored from a botanical standpoint. I take great pleasure in dedicating this striking species to the collector, a friend of fifty years standing. Doctor Fairchild was actually in Amboina on the "Cheng Ho" Expedition, sponsored by the Fairchild Tropical Garden, and financed by Mrs. Anne Archbold, when the outbreak of the second world war rendered further field work impossible. In fact after departing from Amboina on the trip north to the Philippines, the "Cheng Ho" was not supposed to make any stops south of Mindanao. The one stop in Halmahera resulted in the discovery of this beautiful tree.

Elaeocarpus ferrugineus (Jack) Steud. Nomencl. ed. 2, **1**: 545. 1840; Airy Shaw, Kew Bull. **1949**: 165. 1949.

Monocera ferruginea Jack, Mal. Miscel. **1**(5): 44. 1820, iter. Hook. Bot. Miscel. **2**: 86. 1830, iter. Calc. Jour. Nat. Hist. **4**: 226. 1843, iter. Misc. Pap. Ind. Ch. II. **2**: 244. 1887 (Trübner's Oriental Series).

Elaeocarpus jackianus Wall. List. no. 2679. 1832, *nom.* (prob.); Wall. ex King, Jour. As. Soc. Beng. **60**(2): 137. 1891 (Mater. Fl. Malay. Penin. **1**: 246), descr.

Elaeocarpus borneensis Knuth, Repert. Sp. Nov. **44:** 127. 1938.

The type of Knuth's species was *Beccari 3490* from Sarawak of which I have a specimen. I agree with Airy Shaw that it is typical *E. ferrugineus* (Jack) Steud. (*E. jackianus* Wall., as Ridley recorded it in 1938). Jack's type was from Singapore and I suspect that *E. jackianus* Wall. List no. 2679. 1832, *nom. nud.*, really belongs here, as Wallich based the name on a Singapore collection by William Jack; but there is no specimen, merely a label pasted on a sheet, in the set of Wallich specimens at Kew, and no specimen in the Kew herb. proper. King, however, accepted the binomial. It is common in various parts of the Malay Peninsula and tends to colonize abandoned clearings.

Elaeocarpus glaber Blume, Bijdr. 122. 1825; Koord. & Val. Meded. Lands Plant. **33:** 416. 1900 (Bijdr. **5:** 416), Atlas Baumart. Java **3:** *pl. 427.* 1914.

Elacocarpus hosei Merr. Jour. Straits Br. Roy. As. Soc. **77:** 197. 1914, *syn. nov.*

Hose 25 from Sarawak typifies *Elaeocarpus hosei* Merr., but I am now convinced, following Airy Shaw's suggestion, that this species is not sufficiently distinct from *E. glaber* Blume. I have seen the material in the Rijksherbarium, Leiden, named by Blume. Dr. Adelbert, Blumea **6:** 211. 1947, discussed *E. glaber* Blume with *E. floribundus* Blume, but did not reduce the former, indicating certain differences, but thought that intermediates occurred. The following collections in the herbarium of the Arnold Arboretum I take to represent *E. glaber* Blume: SUMATRA: *Korthals*; BORNEO: *Korthals, Hose 25, Wood 1915, Beccari 1197, Richards 2209* (narrow leaved form), *Native collector 2139* (*B. S.*). My impression is that as between *Elaeocarpus glaber* Blume and *E. floribundus* Blume two really distinct species are represented; yet with Blume's very short diagnoses and the fact that he sometimes applied the same specific name to specimens which manifestly represent different species, makes it difficult to determine what his holotype really was. See p. 164 for a Philippine record of this species.

Elaeocarpus grandiflorus Sm. in Rees Cyclop. **12:** no. 5, 1809; Hook. Bot. Mag. 78: *pl. 4680.* 1852; Koord. & Val. Meded. Lands Plant. **11:** 242. 1894 (Bijdr. **1:** 242), Atlas Baumart. Java 3: *pl. 431.* 1914; Pierre, Fl. Forest. Cochinch. **2:** *pl. 142.* 1888; Gagnep. Fl. Gén. Indo-Chine **1:** 568. 1910; Corner, Gard. Bull. Straits Settl. **10:** 319. 1939.

Elacocarpus lanceolatus Blume, Bijdr. 119. 1825.

Monocera lanceolata Hassk. Cat. Hort. Bogor. 208. 1844.

The characters and limits of this species are well understood. Possibly the only reason for including it in these notes is the erroneous entry in Index Kewensis, wherein it is credited solely to Australia; it does not occur there. Hooker in 1852 correctly credited it to Java. To be certain I secured a photograph of Smith's type through the kind offices of Mr.

S. Savage, Secretary of the Linnean Society; an examination of this clearly indicates that the current interpretation of the species is correct. Smith indicated no locality, merely stating that his specimen had been received from Sir G. L. Staunton who collected it on his voyage to China; the place would have been West Java where the sailing ships of those days (1793), enroute to China, stopped for supplies and water as they passed through the Sunda Straits. I have ample material from Java, Sumatra, Lombok, Bali, the Calamian Islands in the Philippines, Indo-China, and Siam; it occurs also in Burma and in the Malay Peninsula. Corner, l.c., who described in detail the form occurring in the Malay Peninsula, states that this "might be called var. *parviflora*." There are some differences between the Indo-China and Siam and the Java specimens but I refrain from setting up minor categories. Specimens examined included *Winckel 782*, *Horsfield*, *Hoffmanseeg*, *Hasskarl*, *Blume*, *DeVriese*, *Lobb* (one of his sheets at Kew labelled "India" but surely from Java), *Koorders*, and *Sargent* from Java; *Koorders* from Sumatra; *DeVoogt 2063*, Lombok; *Van Steenis 7733*, Bali; *Weber 1554 bis*, Busuanga; *Herre 1054*, Culion; *Pierre 3845*, *Petelot 6420*, *Poilane 10896*, *13696*, *15055*, *15249*, *32406*, from Indo-China, and *Kostermans 439*, *1357* from Siam. The many modern collections cited are in the herbarium of the Arnold Arboretum, mostly having been acquired in the past fifteen years; the older collections listed are at Kew and at Leiden, there being many other collections in the latter place.

Elaeocarpus gustaviifolius Knuth, Repert. Sp. Nov. **50**: 84. 1941.

Elaeocarpus magnifolius Knuth, op. cit. **44**: 129. 1938, non Christoph. (1935), *syn. nov.*

The types are *Clemens 29481*, in flower, and *Clemens 28078*, in fruit, both from Tenompok, Mount Kinabalu at 1600 m., and, I strongly suspect, taken from the same tree. At any rate but a single species is represented, and this a very characteristic, strongly marked one. There is no specimen of *Clemens 28078* in the Arnold Arboretum set but I examined the one in the Kew set. Knuth did not realize that the first binomial published by him was invalid, nor did he realize, in 1941, that he was redescribing the same species under a different name.

Elaeocarpus kinabaluensis Knuth, Repert. Sp. Nov. 49: 70. 1940.

This species was based on *Clemens 29131*, *30238* from Mount Kinabalu. Additional but previously uncited numbers, all from the type locality, are *Clemens 32474*, *32495*, *32602*, *32689*, *32999*, *39463*, the last number cited being with mature flowers and by far the best prepared and most representative specimen that I have seen. The mature petals are appressed pubescent on the back with shining hairs, the ovary is ovoid, sparingly white sericeous, and one anther cell is prolonged into a usually spreading or recurved awn about 1 mm. in length.

Elaeocarpus kraengensis Knuth, Repert. Sp. Nov. 50: 84. 1941.

Elaeocarpus monticola Warb. l.c. in syn., non Ridl.

The type was *Warburg 16910* from Wawo-Kraeng, Celebes, of which

there is an ample specimen, lacking petals and stamens, in the Arnold Arboretum herbarium. From this, in view of the fact that the holotype in Berlin was destroyed, fragments have been sent to Kew and to Leiden. I have not been able to match the species in the numerous Malaysian, Philippine, and Papuan specimens I have examined. Incidentally, *E. monticola* Warb. published l.c. as a synonym (non Ridl.), is an unlisted binomial.

Elaeocarpus macrocerus (Turcz.) comb. nov.

Monocera macrocera Turcz. Bull. Soc. Nat. Mosc. **19**(*2*): 494. 1846.
Elaeocarpus littoralis Kurz, Jour. As. Soc. Bengal **43**(*2*): 132. 1874, *nom.*, For. Fl. Brit. Burma **1:** 167. 1877, *descr.* (an Teijsm. & Binn. Cat. Hort. Bogor. 390. 1866, *nom.?*); Pierre Fl. Forest. Cochinch. **2:** *pl. 141.* 1888; Koord. Bull. Jard. Bot. Buitenz. III. **1:** 141, *pl. 7, 8.* 1919, *cum syn.*; Corner, Gard. Bull. Straits Settl. **10:** 321. 1939; Adelb. Blumea **6:** 310. 1947.
Elaeocarpus obtusus sensu King, Jour. As. Soc. Bengal **60**(*2*): 134. 1891 (Mater. Fl. Malay. Penin. **1:** 343), non Blume.

The earliest description of this characteristic and widely distributed species is that of Turczaninow, the type being *Cuming 2331* from Malacca, distributed with a printed Philippine label. Those who have considered its nomenclature were probably misled by the currently accepted but erroneous reduction of Turczaninow's species to the different, but allied, Philippine *E. monocera* Cav. King noted that the Burma form which Kurz actually described was not the same as the form that Teijsmann and Binnendick originally named as *E. littoralis*. This being so, Corner, in 1939, correctly cited Kurz as the author of the binomial he then accepted. I have not been able to check King's statement as I have seen no material of the Sumatran collection on which the binomial was originally based (as a *nomen nudum*), and the Burma material that Kurz actually described is available only in Calcutta. However this little quibble as to an authority is now eliminated by the discovery of an earlier valid specific name.

Adelbert in 1947 concluded that *Elaeocarpus pierrei* Koord. & Val., of Java, was not sufficiently distinct to be recognized as a separate species. I feel rather certain that *Monoceras cuneifolium* Miq. Fl. Ind. Bat. Suppl. 409. 1862, of Sumatra, belongs here, and that *Monocera lanceolata* Hassk. ex Turcz. Bull. Soc. Nat. Mosc. 19(*2*): 493. 1846, type *Zollinger 1557*, from Java, is but a small leaved form of the species here considered; it is not *Elaeocarpus lanceolatus* Blume as the Zollinger specimen was originally identified. Thus the synonymy of *E. macrocerus* (Turcz.) Merr. may be considerably increased. My interpretation of the species has been based on an examination of more than twenty individual collections from the wide range Nicobar and Andaman Islands, Indo-China, Malay Peninsula, Sumatra, Riouw, Borneo, and Java, including flowers of *Cuming 2331*, the type collection, kindly supplied by Mr. Airy Shaw, and two duplicate sheets of *Pierre 3844* on which the latter's excellent plate was based.

Elaeocarpus multinervosus Knuth, Repert. Sp. Nov. **44:** 130. 1938 (June 30).

Elaeocarpus polycarpus Stapf ex Ridl. Kew Bull. **1938:** 230. 1938 (Aug. 15).

Beccari 2698 from Sarawak is the type of both described species as Airy Shaw noted, Kew Bull. **1949:** 163. 1949, Knuth's name having one and a half month's priority. Another collection is *Synge 490* in 1932, Kew and Arnold Arboretum.

Elaeocarpus nitidus Jack, Mal. Misc. 1(5): 41. 1820, iter. Hook. Bot. Misc. **2:** 84. 1830, iter. Calc. Jour. Nat. Hist. **4:** 224. 1843, iter. Misc. Pap. Ind. Ch. II. **2:** 242. 1887 (Trübner's Oriental Series); Corner, Gard. Bull. Straits Settl. **10:** 323. 1939; Airy Shaw, Kew Bull. **1949:** 165. 1949.

Elaeocarpus nigropunctatus Merr. Jour. As. Soc. Straits Br. **77:** 196. 1917.
Elaeocarpus barbulatus Knuth, Repert. Sp. Nov. **44:** 126. 1938.
Elaeocarpus gracilipes Knuth, op. cit. **49:** 70. 1940, *syn. nov.*

I follow Corner's interpretation of Jack's species, the type being from Penang. He called attention to King's misinterpretation of it in 1891. The reductions of *E. nigropunctatus* Merr. (type, *734 Native collector, B. S.*, Sarawak) and *E. barbulatus* Knuth (type, *Clemens 21662*, Sarawak) are by Airy Shaw, which I accept. I add the reduction of *E. gracilipes* Knuth (type, *Beccari 1026*, from Sarawak). Airy Shaw says that *Elaeocarpus parvifolius* Wall. as first described by Mueller in 1849 is scarcely the same as Jack's species, but although I have not seen *Wallich 2662*, I incline to the view that it belongs here. This is a point for some future monographer to solve. I have examined about 25 individual collections from the Malay Peninsula, Sumatra, and Borneo, including isotypes of the three reduced species.

Elaeocarpus obtusus Blume, Bijdr. 123. 1825; Koord. & Val. Meded. Lands Plant. **11:** 244. 1894 (Bijdr. **1:** 244), Atlas Baumart. Java 3: *pl. 421, 422.* 1914; Adelb. Blumea **6:** 312. 1947; Airy Shaw, Kew Bull. **1949:** 165. 1949.

Monoceras robustum Miq. Fl. Ind. Bat. **1**(2): 212. 1859, non *Elaeocarpus robustus* Roxb.
Elaeocarpus miquelii Hochr. Pl. Bogor. Exsic. 27. 1904, quoad syn., excl. nota et spec. no. 50.

I have seen but few good specimens of this species from Java, Sumatra, and Borneo. Others placed here are either sterile, or in fruit. An isotype of Miquel's species, *Zollinger 3166*, distributed with a Java label, is in the Arnold Arboretum herbarium; it may have been collected in Sumatra. Hochreutiner published his *Elaeocarpus miquelii* as a new name for this form, which, superficially, suggests *E. macrocerus* (Turcz.) Merr. (*E. littoralis* Kurz.). The specimens he erroneously associated with *E. miquelii* Hochr. actually belong with the very different *E. pedunculatus* Wall. A striking character of Blume's species is the very short anther-awn, for in the similar species the anther-awn is very long and conspicuous.

Elaeocarpus octantherus Aug. DC. Bull. Herb. Boiss. II. 3: 367. 1903.

Elaeocarpus microphyllus Warb. Repert. Sp. Nov. 18: 338. 1922, non Elm. (1911), *syn. nov.*

Both descriptions were based on the same collection, *Beccari 3224* from Sarawak; Warburg did not realize that he was redescribing an already characterized species. Ridley, Kew Bull. 1938: 234. 1938, expressed the opinion that this Bornean species is only a mountain form of the lowland *E. mastersii* King of the Malay Peninsula.

Elaeocarpus pachyophrys Warb. Repert. Sp. Nov. 18: 327. 1922.

Elaeocarpus luridus Stapf ex Ridl. Kew Bull. 1938: 232. 1938, *syn. nov.*

Warburg cited the type of his new Bornean species as *Beccari 3278* which is an error due either to a "mixed label" or in transcription. Unfortunately the holotype no longer exists. What was manifestly intended was *Beccari 3187*, which happens to be the type of *Elaeocarpus luridus* Stapf ex Ridley. There is no *Beccari 3278* among the *Elaeocarpus* specimens in the Kew set of Beccari collection, nor in the original Florence set which is with me on loan. Dr. Pichi Sermolli informs me that *Beccari 3278* is the dipterocarpaceous *Pachynocarpus umbonatus* Hook. f. Comparison of the two descriptions, as far as they are comparable, shows very close similarities, and correcting certain erroneous measurements in the one that Ridley prepared (petiole length from 4–6 m. to 4–6 cm.; sepal length from 3 mm. to 5 mm.), for I have examined Stapf's type, there is very close agreement. Both authors mention the ascending lateral nerves, and they do leave the midrib at an unusually acute 60° angle, which is much sharper than in most other species of the genus. This reduction of *Elaeocarpus luridus* Stapf ex Ridl. (1938) to *E. pachyophrys* Warb. (1922) is clearly indicated, both descriptions having unquestionably been based on duplicates of the same collection, in spite of the differences in the actually cited number.

Elaeocarpus palembanicus (Miq.) Corner, Gard. Bull. Straits Settl. 10: 323. 1939; Adelb. Blumea 6: 312. 1947.

Monoceras ? palembanicum Miq. Fl. Ind. Bat. Suppl. 408. 1862.

Elaeocarpus hullettii King, Jour. As. Soc. Beng. 60(2): 134. 1891 (Mater. Fl. Malay. Penin. 1: 243).

Elaeocarpus leptomischus Ridl. Jour. Fed. Malay States Mus. 5: 30. 1913, Fl. Malay Penin. 1: 320. 1922.

Miquel's type, a fruiting specimen, was a Teysmann collection from Sumatra. A proper solution of its status is a good illustration of the difficulties one encounters in trying to interpret a species, in such a group as this, where floral characters are essential in all schemes of classification currently used. Adelbert in 1947, after studying Miquel's type, noted that Koorders and Valeton had placed the species as a synonym of *E. griffithii* (Wight) A. Gray, but he apparently was not sufficiently certain to express a definite opinion. Corner reached his conclusion apparently in part on the basis of modern Sumatran collections identified at Buitenzorg.

After seeing specimens actually named by Miquel at Utrecht and at Leiden and comparing these with other collections representing the species described from the Malay Peninsula, I have concluded that Corner's interpretation is probably correct. Malay Peninsula, Sumatra, Borneo.

Elaeocarpus rumphii Merr. Interpr. Herb. Amb. 349. 1917, quoad descr., excl. syn.

My technical description of this species was based wholly on *Robinson 370* from Amboina. The species is further represented by *Neth. Ind. For. Serv. bb28884* from the Sula Islands. In 1917 I referred here, with expressed doubt, *Arbor rediviva, Eyparehu* Rumph. Herb. Amb. 3: 165. *pl. 104*. 1743. I am now certain that the form or forms that Rumphius described do not belong with *E. rumphii* Merr. On page 165, Rumphius gave an ample description of a fruiting specimen (which he did not figure). The fruit description is definitely not that of *Elacocarpus*, the endocarp being described as: "hexagonum — quorum tres anguli magis protuberant, atque nucleum postissimum trigonum formant, in acutum durumque desinens apicem." This suggests fruits of *Aceratium oppositifolium* DC., yet Rumphius was silent as to the position of the leaves. On page 166, however, from an appendix prepared by Rumphius, is published a description of a flowering specimen of what Rumphius took to represent the same species that he previously knew only from a fruiting material. This is in all respects an *Elaeocarpus, and is, moreover, the form that Rumphius illustrated in his plate 104;* the lower figure on this plate represents a fruiting branchlet of the same form figured in flower in the upper figure, but definitely not the form to which Rumphius's original description of the fruits applies. He indicated the leaf measurements as 3–4 × 2 inches. I interpret the Rumphian entity from the description in this appendix as his illustration was based on the same material. One should not be misled by the 4 to 6 irregularly scattered protuberances shown on the leaf surfaces as these are manifestly small galls. *Arbor rediviva* is further discussed under *Elaeocarpus crenatus* (Raf.) Merr. In some respects the description of *Elaeocarpus batjanicus* Warb. ex Knuth, Repert. Sp. Nov. 49: 68. 1940, type *Warburg 18257* from Batjan Island, a fruiting specimen, suggests *E. rumphii* Merr., but it has larger leaves and occurs at 1800 m. altitude; *E. rumphii* Merr. is a low altitude species (175–300 m.).

Elaeocarpus salicifolius King, Jour. As. Soc. Bengal 60(2): 125. 1891 (Mater. Fl. Malay. Penin. 1: 234); Ridl. Fl. Malay Penin. 1: 313. 1922.

Elaeocarpus stenophyllus Merr. Papers Michigan Acad. 19: 168. 1934, *syn. nov.*

Having been able to compare *Bartlett 7022* from Sumatra type of *E. stenophyllus* Merr. with the type number of King's species from Singapore, and with several modern collections from Singapore and Johore, I note that the supposed differences do not exist. I have seen no fruits, the only published description of them being Ridley's inadequate "Drupe oblong, green." Corner, however, Gard. Bull. Straits Settl. 10: 316. 1939, placed

the species among those having the bony endocarp (his "stone") 1.5 to 4 cm. wide.

Elaeocarpus stipularis Blume, Bijdr. 121. 1825.

Elaeocarpus tomentosus Blume, l.c.
Elaeocarpus fissistipulus Miq. Fl. Ind. Bat. **1**(*2*): 210. 1859.
Elaeocarpus scortechinii King, Jour. As. Soc. Beng. **60**(*2*): 124. 1891 (Mater. Fl. Malay. Penin. **1**: 232).
Elaeocarpus gambir Becc. Nelle Foreste di Borneo. 594. 1902, *nom.*
? *Elaeocarpus mindanaensis* Merr. Philip. Jour. Sci. **3**: Bot. 150. 1908.
Elaeocarpus nutans Knuth, Repert. Sp. Nov. **44**: 131. 1938, *syn. nov.*

The type of Knuth's species was *Beccari 3191* from Sarawak. This I have seen as well as the Javan specimens at Leiden named by Blume, some as *E. stipularis* Blume, others as *E. tomentosus* Blume, as well as about 50 individual collections in the Arnold Arboretum herbarium from the Malay Peninsula, Sumatra, Java, and Borneo. Knuth did not mention the stipules of his proposed new species; they are the typical ones of *E. stipularis* Blume, inequilateral, pubescent, up to 8 or 9 mm. long and with 2 or 3 prominent lobes on one side as in *E. fissistipulus* Miq.

All botanists who have recently considered this complex are in general agreement that the two species that Blume very briefly described in 1825 cannot be distinguished by constant characters, including Ridley, Kew Bull. 1938: 233. 1938, Corner, Gard. Bull. Straits Settl. 10: 327. 1939, and Adelbert, Blumea 6: 312. 1947, they merely confirming the conclusions of earlier workers such as Koorders and Valeton, Hochreutiner, Hallier f. and Backer (annotations of the last two on historical sheets at Leiden). The supposed differences as between the Java and the Malay Peninsula specimens as to the numbers of stamens and ovary-cells fail. Under the circumstances it seems to be logical to interpret this species as a somewhat variable one, pending a critical revision of the entire group. To it I am now convinced *E. fissistipulus* Miq. (type from Java) and *E. scortechinii* King (type from Perak), must be reduced, and they have been so disposed of by one or another of the botanists above mentioned. Ridley has even reduced *E. brevipes* Merr. (1922), type from Borneo, to Blume's species, but I do not accept this. I do suspect, however, that *E. mindanaensis* Merr., type from Lanao, Mindanao, may prove to be but a form of Blume's species. Unfortunately, the material available to me is limited and not complete. One of the difficulties encountered, and this is perhaps one of the reasons why so many forms have been optimistically characterized as distinct species, is that the characteristic lobed stipules are deciduous. In a very high percentage of all the very numerous specimens I have examined, lobed stipules are not in evidence. I judge them to be more characteristic of vigorously growing young branchlets.

Elaeocarpus submonoceras Miq. Fl. Ind. Bat. Suppl. 407. 1862.

Elaeocarpus longifolius Blume var. *fusiformis* Corner, Gard. Bull. Str. Settl. **10**: 321. 1939, *syn. nov.*

Miquel's type was from Palembang, Sumatra, a specimen collected by

Teysmann (no. *3684*), which I saw at Utrecht and regarding which I made brief notes. Corner, on the basis of Miquel's description suggested that his new variety, which I do not think belongs with *E. longifolius* Blume, was apparently closely allied to Miquel's species if not identical with it. This was independently confirmed by Mr. Airy Shaw at Kew by comparison of two *Teysmann* specimens, one named by Miquel and doubtless an isotype, with *C. F. 15601* from Pahang, cited by Corner in the description of the variety above reduced.

Elaeocarpus acmosepalus as originally named by Stapf (but not as later described by Ridley) is involved here. Stapf named *Beccari 3433* and *Haviland 2035* from Borneo, but in taking up the specific name Ridley applied it, in part, to an unnumbered *Cantley* specimen from Johore on which his description (not that of Stapf) was essentially based. I agree with the expressed opinion of Mr. Airy Shaw that the species as defined by Ridley should be typified by this *Cantley* specimen, not by the Bornean specimens which Stapf originally named, and that the authority for the binomial as published should be Ridley, not Stapf. Ridley noted that one of the characters of the new species was its 3-nerved leaves (the actual *Cantley* specimen in the Kew herbarium has leaves with 3 to 5 pairs of nerves), while the Bornean material, which Stapf named and which Ridley saw, has 5 to 8 pairs of lateral nerves, and *Beccari 3433* as many as 10 pairs. For the present I refer here *Teysmann 3684* from Sumatra, Miquel's type, *Beccari 3433* from Pontianak (not from Sarawak), as well as *Teysmann 8127, 8136* in herb. Beccari, a *Korthals* specimen from Borneo, as well as *Forbes 1608* from Sumatra referred to Miquel's species by Baker f., and finally from the Malay Peninsula *C. F. 4151*, and according to Airy Shaw also *C. F. 3186, 15601*, all cited by Corner in his description of the variety above reduced. Mr. Airy Shaw in one of his letters to me has suggested that *E. oxypyren* Koord. & Val. might eventually be united with Miquel's species. More material than is available to me is needed to settle this matter.

Elaeocarpus subpuberus Miq. Fl. Ind. Bat. Suppl. 406. 1862.

Elaeocarpus valetonii Hochr. Pl. Bogor. Exsic. 29. 1904, *syn. nov.*

BRITISH NORTH BORNEO: Mount Kinabalu, *Clemens 25928, 33138*, Tenompok and Marai Parai Spur, alt. about 1500 m., Mar. 3 and 7, 1932 and 1933. Sumatra, Simaloer, Bangka, Billiton; cultivated at Buitenzorg, Javà.

The specimens in this complex strikingly resemble each other in vegetative and inflorescence characters, color when dry, etc., but differ somewhat in the indumentum on the petals. While for the present I prefer to recognize but a single species, it is possible that a critical study of all available specimens may show that there are two or possibly three very closely allied forms to be distinguished chiefly or only by the nature of the indumentum on the petals. The Clemens specimens which I now refer here remained unnamed although at Leiden one of the numbers had been erroneously identified as representing the very different *E. oblongus* Gaertn. They are very similar to Miquel's type, which I perhaps too

hurriedly examined at Leiden, and *Hochreutiner Pl. Bogor. Exsic. 55* the type of *Elaeocarpus valetonii* Hochr. but a species never technically described by him. He thought that his new species resembled *E. nitidus* Jack and *E. floribundus* Blume, and expressed the opinion that it might find its place in the alliance with *E. ganitrus* Roxb., the latter generally considered to be a synonym of the older *E. sphaericus* (Gaertn.) K. Schum. It seems to me that the species, or group of several closely allied ones, is remote from all of those Hochreutiner listed.

Miquel's type was a Teysmann collection (no. *3611*) from Ogan-ulu, Palembang, Sumatra. His description of the petals is merely that they are "obovata, superne fimbriato-multifida, marginibus inferne ciliata." Hochreutiner's type was from a tree cultivated at Buitenzorg, presumably VI. C. 97, which he records as having come from Bangka; at Leiden is a specimen of VI. C. 97 labelled as from Bangka and another specimen of this same number labelled as having come from Lampongs, Sumatra. In the Bornean specimens above cited the petals are but slightly pubescent on both surfaces, with short appressed hairs, while in the Buitenzorg material the petals are much more pubescent on both surfaces, the hairs long and appressed. I have not been able to examine the petal characters of Miquel's species, but Dr. H. Lam verifies the fact that the resemblances between the supposedly two distinct species are very strong but that the sepals of Miquel's species are more pubescent outside than are those of *E. valetonii* Hochr. Airy Shaw, Kew Bull. 1949: 165. 1949, has suggested that Miquel's species may belong with *E. glaber* Blume, but after examining Blume's type, the excellent Koorders and Valeton plate (Atlas Baumart. Java 3: *pl. 427*. 1914) and comparing about a dozen individual collections from Java, Sumatra, and Borneo all identified as *E. glaber* Blume, I do not think that Miquel's species should be reduced to the earlier one of Blume.

Additional collections are *Achmad 1144* from Simaloer, *Van Rossum 13* and a specimen numbered *83*, no collector indicated, from Billiton, and *Grashoff 99* from Bangka.

Elaeocarpus tectorius (Lour.) Poir. in Lam. Encycl. Suppl. **2**: 704. 1812; Seem. Fl. Vit. 28. 1865, in nota; Merr. Trans. Am. Philos. Soc. II. **24**(2): 256. 1935.

Craspedum tectorium Lour. Fl. Cochinch. 336. 1790.

Elaeocarpus oblongus sensu J. E. Sm. in Rees Cyclop. **12**: no. 2. 1809, non Gaertn.

Dicera craspedum J. F. Gmel. ex DC. Prodr. **1**: 520. 1824.

Elaeocarpus robustus Roxb. Hort. Beng. 42. 1814, *nom.*, Fl. Ind. ed. 2, **2**: 597. 1832, *descr.*; Mast. in Hook. f. Fl. Brit. Ind. **1**: 402. 1874; Gagnep. in Lecomte, Fl. Gén. Indo-Chine **1**: 577. 1911, Suppl. **1**: 490. 1945; Corner, Gard. Bull. Straits Settl. **10**: 325. 1939.

Elaeocarpus leptostachyus Wall. List no. 2672. 1831, *nom.*, C. Muell. Anot. Fam. Elaeoc. 23. 1849, *descr.*

Elaeocarpus ovalifolius Wall. l.c. no. 2655, *nom.*, C. Muell. op. cit. 21, *descr.*

Elaeocarpus nitidus sensu King, Jour. As. Soc. Bengal **60**(2): 127. 1891 (Mater. Fl. Malay. Penin. **1**: 236), non Jack.
Elaeocarpus macrocarpus Ridl. Fl. Malay. Penin. **1**: 321. 1922.

There are in the herbarium of the Arnold Arboretum about thirty individual collections of this complex (mostly distributed as *Elaeocarpus robustus* Roxb.), from various parts of Bengal, Assam, Burma, Indo-China, the Andaman Islands, Sumatra and the Malay Peninsula. It so happens that Loureiro's actual type is preserved in the herbarium of the British Museum, and that Seemann, who examined it, considered it to represent the same species as the one Roxburgh later characterized. Mr. Exell, at my request, kindly reexamined the Loureiro type in December, 1950, and reports that it appears to be very similar to *Elaeocarpus robustus* Roxb., and that Spencer Moore had written on the sheet: "This is very close to *E. robustus* Roxb. and perhaps conspecific with it. But the flowers are too young to decide the point." While I have not personally examined the Loureiro specimen, I call attention to the fact that there are at least two modern collections available from near the type locality, these collections being from Tourane (Poilane) and from Hue (*Clemens 3688*); Loureiro resided at Hue for many years. I am willing to admit that, as the species was interpreted by Corner, Gard. Bull. Straits Settl. 10: 325. 1939, who for his own reasons retained the Roxburgh binomial, a really critical study might indicate that there may be two or more distinct ones involved; but I cannot understand why he should discard the Loureiro binomial. He queried: "If Loureiro invented it [the fruit description in the *generic* one], then what might he not have invented?" Clearly in this case Loureiro, in preparing his generic description did "guess" at the fruit characters, but no mention of the fruit is made in the species description, while Loureiro's generic name was derived from the petal characters; his really excellent specific description is all *Elaeocarpus*, and his type, a flowering specimen, is extant. The whole species description, as I understand it, applies to the *Elaeocarpus* here considered. I see no reason for abandoning what I consider to be the oldest valid specific name for this widely distributed Asiatic species, as to me, Corner's expressed reasons for not displacing the Roxburgh name by the earlier Loureiro one, are illogical. He knew that the Loureiro type was extant, and this, I contend, may not be ignored. I do not think that an apparent dislike for changing a long accepted specific name, when an earlier one is located, is any reason for ignoring the priority rule; and I merely note in passing that Poiret's transfer of Loureiro's specific name antedates Roxburgh's description by 20 years. I note also that Roxburgh's artist so grossly exaggerated the floral characters of *E. robusta* Roxb., that unless this be realized one would scarcely place any of the named specimens under the Roxburghian binomial from an inspection of the figures; see Wight, Ic. Pl. Ind. Or. 1: *pl. 64*. 1838, which is a reproduction of Roxburgh's drawing. Until Seemann is shown to be in error in his interpretation of Loureiro's extant type, I maintain that his specific name must be maintained, whether one wishes to do so or not.

Elaeocarpus teijsmannii Koord. & Val. Meded. Lands Plant. **19:** 368. 1898, *nom.*, Ic. Bogor. **2:** 139. *pl. 128.* 1904, *descr.;* Hochr. Pl. Bogor. Exsic. 28. 1904; Koord. Suppl. Fl. Celeb. **3:** 30. *pl. 62.* 1922 (*teysmannii*); Van Steenis, Bull. Jard. Bot. Buitenz. III. **18:** 210. 1949.

Elaeocarpus micranthus Teijsm. & Binn. Cat. Hort. Bogor. 390. 1866, *nom.*, non Vieillard (1865).

Elaeocarpus celebesianus Baker f. Jour. Bot. **62:** Suppl. 14. 1924.

This species, other than the tree cultivated at Buitenzorg, Java, is known only from Celebes, and from this cultivated tree (VI. C. 193) was taken not only *Hochreutiner Pl. Bogor. Exsic. no. 53*, but also *Forbes 1185a* on which Baker's description was based. The printed label on the specimen of *Forbes 1185a* reads "South East Java," but the record is otherwise clear. Van Steenis clarified this case in 1949.

Elaeocarpus timorensis Knuth, Repert. Sp. Nov. **48:** 79. 1940.

The type of this species was *Stein 719* which was in the now destroyed Berlin herbarium. This specimen was from Kappan, Timor, alt. 1000 m. A topotype, and this specimen agrees fully with Knuth's description, is *Netherl. Ind. For. Serv. bb. 27126* from the same locality, "Nasimitan, bij Kapan, ± 900 m. alt." This was distributed as representing the different *E. petiolatus* Wall. One very striking difference is the much thickened (1 cm.) ultimate branchlets of the Timor species, these with numerous scars of fallen leaves.

Elaeocarpus validus Knuth, Repert. Sp. Nov. **49:** 72. 1940.

The type of this was *Clemens 32447*, from Marai Parai Spur, Mount Kinabalu. Other collections not previously cited from the same locality, Dallas, and Penibukan, are *Clemens 30913, 32023, 32946.* The one fruit I have seen is narrowly oblong-ovoid, 1-celled, 1.5 cm. long, 8 mm. thick, glabrous, pale, shining, and wrinkled when dry. Not matched by any other described species.

NEW GUINEA AND THE SOLOMON ISLANDS[3]

The reductions of several species described by Dr. A. C. Smith in 1944 are indicated below, as they were all characterized under different specific names by Knuth three years earlier. The Knuth publication of

[3] Here is adjusted the nomenclature of one New Guinea species of *Sloanea*, another genus belonging in the Elaeocarpaceae:

Sloanea arfakensis (Kaneh. & Hatus.) comb. nov.

Echinocarpus arfakensis Kaneh. & Hatus. Bot. Mag. Tokyo **56:** 314. *fig. 8.* 1942.

Sloanea archboldiana A. C. Sm. Jour. Arnold Arb. **25:** 294. 1944, *syn. nov.*

A duplicate of the type collection of *Echinocarpus arfakensis* Kaneh. and Hatus., *Kanehira & Hatusima 13675*, is in the herbarium of the Arnold Arboretum, my attention having been called to it by Dr. L. M. Perry. It represents the same species as *Sloanea archboldiana* A. C. Sm., and in fact was cited by Smith in the original description of that species. Volume 56 of the Tokyo Botanical Magazine did not reach the United States until after the close of the Second World War.

1941 did not become available to American botanists until after the close of the Second World War.

Elaeocarpus albiflorus Knuth, Repert. Sp. Nov. **50:** 81. 1941.

Elaeocarpus leptopus A. C. Sm. Jour. Arnold Arb. **25:** 234. 1944, *syn. nov.*

NORTHEASTERN NEW GUINEA: The type collection for both is *Clemens 2022.* Another collection cited by Knuth is *Clemens 823,* a fruiting specimen, also in the herbarium of the Arnold Arboretum which Dr. Smith did not name, but which clearly represents the same species as *Clemens 2022.* A species of the section *Ganitrus.*

Elaeocarpus densiflorus Knuth, Repert. Sp. Nov. **50:** 82. 1941.

Elaeocarpus decorus A. C. Sm. Jour. Arnold Arb. **25:** 242. 1944, *syn. nov.*

NORTHEASTERN NEW GUINEA: The type of both is *Clemens 2420.* Other collections are *Clemens 3745, 3398, 4799, 5398, 8168, 8756, 9427,* all cited by Knuth; those available in the herbarium of the Arnold Arboretum, all cited by Smith, are *Clemens 2420, 3745, 4799, 11165, 12323.* Placed by Smith in the section *Fissipetalum.*

Elaeocarpus lancipetalus sp. nov. § *Coilopetalum.*

Arbor novellis inflorescentiisque plus minusve pubescentibus exceptis glabra, ramis teretibus, ramulis ultimis circiter 1.2 mm. diametro, partibus vetustioribus glabris, novellis leviter pubescentibus; foliis numerosis, in ramulis ultimis subconfertis, oblongo-oblanceolatis vel subelliptico-oblanceolatis, coriaceis vel subcoriaceis, 5–7 cm. longis, 1.5–3 cm. latis, basi cuneatis, apice distincte sed obtuse acuminatis, margine deorsum integris, sursum leviter crenulatis, crenulis inter se 2–5 mm. distantibus, minute apiculatis, sicco subolivaceis, subtus paullo pallidioribus et in axillis primariis obscure domatiferis; nervis primariis utrinque 5–6, distantibus, subtus plus minusve elevatis, distinctis, curvatis, laxe arcuato-anastomosantibus, subtus secus costam nervosque leviter adpresse pubescentibus glabrescentibus; petiolo 5–10 mm. longo, glabro vel obscure adpresse pubescenti; racemis axillaribus, solitariis, plus minusve breviter subadpresse subcinereo-pubescentibus, 4–5 mm. longis; floribus 5-meris, alabastris anguste ovoideis, acutis vel obscure rostrato-acuminatis; sepalis lanceolatis, acuminatis, 6–6.5 mm. longis, 1.2 mm. latis, extus plus minusve adpresse subcinereo-pubescentibus, intus glabris; petalis integerrimis, lanceolatis, acuminatis, sepalis aequantibus, ad 1.5 mm. latis, submembranaceis, extus in partibus medianis leviter adpresse pubescentibus, margine subinvolutis, deorsum retrorse subciliatis, intus in partibus medianis obtuse carinatis, sursum planis et glabris vel subglabris, carinis dense retrorse subvillosis, pilis pallide brunneis, nitidis; staminibus circiter 20, minute pubescentibus, filamentis 2 mm. longis, antheris oblongis, filamentis aequantibus, apice setosis, setis rectis vel curvatis, 1.5 mm. longis; ovario anguste ovoideo, adpresse albido-villoso, 2-loculari, loculis biseriatim 10-ovulatis; stylo glabro, 3.5 mm. longo.

NEW GUINEA: At Ansus, Japen Island, Geelvink Bay, *Beccari 1874* (TYPE), April, 1875; also from Mandamui, Geelvink Bay, *Beccari 1875,*

December, 1875, both specimens in the herbarium of the Instituto Botanico, Florence.

This, by Schlechter's arrangement of the New Guinea species, falls with the very different *Elaeocarpus branderhorstii* Koord., an isotype of which is in the Arnold Arboretum herbarium. The lanceolate, acuminate, quite entire petals are striking characters. It is at once distinguished from the Koorders species by its prominently acuminate leaves, those of *E. branderhorstii* Koord. having broadly rounded apices.

Elaeocarpus multiscissus Knuth, Repert. Sp. Nov. 50: 86. 1941.

Elaeocarpus aemulus A. C. Smith, Jour. Arnold Arb. **25:** 232. 1944, *syn. nov.*

NORTHEASTERN NEW GUINEA: *Clemens 5010, 4910.* The type of both is *Clemens 5019*, and *Clemens 4910* is cited by both authors as representing their species. The species belongs in the section *Ganitrus*.

Elaeocarpus salomensis Knuth, Repert. Sp. Nov. **50:** 87. 1941.

Elaeocarpus solomonensis A. C. Sm. Jour. Arnold Arb. **25:** 226. 1944, *syn. nov.*

SOLOMON ISLANDS: The type of Knuth's species is *Waterhouse B 819* which I have not seen. The type of Smith's species is *Kajewski 2327.* Other specimens, all cited by Smith, are *Waterhouse 96, 177, Kajewski 1752, 2608,* and *Brass 275.* The two species are clearly identical and the entity belongs in the section *Chascanthus*.

Elaeocarpus viscosus Warb. Bot. Jahrb. **18:** 201. 1923; A. C. Sm. Jour. Arnold Arb. **25:** 246. 1944.

Elaeocarpus patens Knuth, Repert. Sp. Nov. **48:** 77. 1940.

Clearly Dr. Smith was correct in reducing *Elaeocarpus patens* Knuth, the type of which was a fruiting specimen, to the earlier *E. viscosus* Warb. I have seen one sheet of the Wallaston expedition collection referred here by Ridley and mentioned by Smith, and I believe that Ridley's identification was correct. Another collection is *Carr 12263.* Known only from New Guinea.

MASCARENE ISLANDS

Elaeocarpus bojeri Vaughan, Mauritius Inst. Bull. 1(1): 17. 1937.

Elaeocarpus grandiflorus Bojer, Hort. Maurit. 45. 1837, *nom.*, Baker, Fl. Maurit. Seychell. 33. 1877, *descr.*, non J. E. Smith (1809).

This species is known only from Mauritius, my attention being called to it in an attempt to solve certain problems regarding the application of the binomial *Elaeocarpus integrifolius* Lam., another species known only from Mauritius. Vaughan was correct in proposing a new name for this species in 1937.

NEW NAMES FOR THREE INDO-CHINESE SPECIES

Elaeocarpus decandrus nom. nov.

Elaeocarpus integripetalus Gagnep. Not. Syst. **11:** 6. 1943, et in Fl. Gén. Indo-Chine Suppl. **1:** 493. *fig. 58, 1–6.* 1945, non Miq. (1862).

The type and only known collection is *Kerr 21067* from Pubia, near Xieng-kouang, Laos.

Elaeocarpus gagnepainii nom. nov.

Elaeocarpus nitens Gagnep. Not. Syst. **11**: 9. 1943, et in Fl. Gén. Indo-Chine Suppl. **1**: 491. 1945, non Knuth (1938).

The type and only known collection of this species is *Poilane 3276* from Nhatrang, Annam.

Elaeocarpus indochinensis nom. nov.

Elaeocarpus parviflorus Gagnep. Not. Syst. l.c. et in Fl. Gén. Indo-Chine Suppl. **1**: 499. *fig. 58, 14–19*. 1945, non A. Rich. (1834), nec Spanoghe (1841).

This is known from Annam and Laos by five *Poilane* collections, his numbers *2289*, *9552*, *12160*, *21795*, and *21959*.

THREE INDIAN SPECIES

Elaeocarpus glandulosus Wall. List no. 6839. 1832, *nom.*

Elaeocarpus adenophyllus Wall. l.c. no. 6860, *nom.*

Elaeocarpus oblongus sensu Wight, Ic. Pl. Ind. Or. **1**: *pl. 46*. 1838; Mast. in Hook. f. Fl. Brit. Ind. **1**: 403. 1874 (excl. syn. *E. perim-kara* DC. et *E. oblongus* sensu Sm.); Brandis, Indian Trees, 103. 1891; Cooke, Fl. Bombay **1**: 152. 1901; Gamble, Fl. Madras **1**: 124. 1915, non Gaertn.

Species *E. serrato* Linn. simillimis, differt antheris nec penicillatis nec ciliatis.

This species, well described by various authors, is widely distributed in peninsular India. I am convinced that it is not the species originally and very inadequately characterized by Gaertner, which below I have reduced to *E. serratus* Linn. Clearly *E. perim-kara* DC. is a synonym of the Linnaean species also. I judge that *E. glandulosus* Wall. and *E. adenophyllus* Wall., both *nomina nuda,* are correctly placed as synonyms of *E. oblongus* auct. plur. (non Gaertn.), and of these I have here deliberately validated the former. *Elaeocarpus glandulosus* Wall. is selected because Wallich indicated its locality as "Ripa Aran 1827," the Aran River being in Berar, central India; for *E. adenophyllus* Wall. no locality is indicated, although as the specimen was from the Heyne herbarium it certainly came from some part of India; this was originally placed in *Olea* from which I judge that the specimen, which I have not seen, may have been a fruiting one.

Elaeocarpus serratus Linn. Sp. Pl. 515. 1753; Trimen, Handb. Fl. Ceyl. **1**: 184. *pl. 20*. 1893.

Elaeocarpus oblongus Gaertn. Fruct. **1**: 202. *pl. 43. fig. 3*. 1791, non auct.
Elaeocarpus perim-kara DC. Prodr. **1**: 519. 1824.

I feel confident that what Gaertner illustrated was the fruit of *Elaeocarpus serratus* Linn., the type of the genus. This species is native of Ceylon and parts of India, and is widely planted, its pickled fruits being extensively used as food corresponding to olives so treated; Trimen says

that the fruit is generally known as "wild olives" in Ceylon, the pulp being pleasantly subacid and palatable. He stressed the point that the stone was invariably 1-seeded. The basis of *E. perim-kara* DC. was *Perin-kara* Rheede, Hort. Malabar. 4: 51. *pl. 24. 1683*, which from Rheede's data, the 1-celled fruit and their indicated uses, with the local names including *azeitones do Malavar* and *Wilde olyven,* clearly indicates the Linnean species. Gaertner, who at the time was concerned with the characters of fruits and seeds, found the fruit, which he so excellently figured, in the seed collection at Leiden. No locality was indicated. The ellipsoid or oblong-ellipsoid fruits with the very rugose 1-celled endocarp are distinctly characteristic and correspond to those of the Linnean species in size and most other characters. I note that generally the fruits of *E. serratus* Linn. are described as somewhat pointed or apiculate; those that Gaertner had have rounded tips both of the fruit and of the endocarp. Yet Cooke in 1901 his Flora of Bombay says that the fruits of *E. serratus* Linn. are 1-celled and bluntly pointed at the apex while those of *E. oblongus* are narrowed at both ends 2-celled and 2-seeded; these latter are apparently the characters of *E. oblongus* auct.; they are not those of the species that Gaertner so inadequately defined.

The binomial *Elaeocarpus oblongus* has had a rather checkered career in botanical literature. Some of the misinterpretations were due, in part, to Gaertner having erroneously included a reference to *Ganitrum oblongum* Rumph. Herb. Amb. 3: 161. *pl. 102*. 1743. The generalized description of the latter, and the rather crude plate, showing a branchlet with fruits, was based on material from Amboina, Celebes, and apparently Bali. There is no reason why this pre-Linnean name should be associated with Gaertner's species. Lamarck, Encycl. 2: 604. 1788, tentatively referred the Rumphian entity to *Elaeocarpus integrifolius* Lam., but the actual type of the latter was a specimen from the Isle de France, and Lamarck's species is still known only from the Seychelles. Later, when he illustrated his species, Illus. *pl. 459. fig. 2*, Gaertner's excellent figure of the fruit was copied as that of *E. integrifolius* Lam., but its source was not mentioned. When in 1917, Interpret. Herb. Amb. 352. 1917, I was trying to determine the status of those binomials wholly or in part based on the pre-Linnaean work of Rumphius, I had communicated with Dr. Hallier regarding the possible identity of the plant Rumphius considered, and the one that Gaertner had named. He then suggested *E. floribundus* Blume as a possibility but clearly that species has nothing to do with either the form Gaertner illustrated or the one Rumphius described. Not being able to reach a conclusion, Gaertner's binomial was recorded and the case was discussed under it. In the course of the present study I have again considered the Rumphian entity and again I can come to no conclusion other than that what he had was an *Elaeocarpus;* but clearly the binomial *Elaeocarpus oblongus* Gaertn. must be eliminated from the Malaysian list.

One of the reasons why I suspected that the Gaertner binomial really belongs in the synonymy of the earlier *E. serratus* Linn., is that when

Masters considered the species of British India, Hook. f. Fl. Brit. Ind. 1: 401. 1874, he actually cited Lamarck's binomial and misleading figure as a synonym of *E. serratus* Linn., not realizing that the fruit as depicted in that figure was copied from Gaertner's illustration; at the same time, on p. 403 he admitted *E. oblongus* Gaertn. as a valid species, without citing Gaertner's figure, but with a somewhat confused synonymy and geographic distribution; certainly the reference to the Moluccas and Borneo must be eliminated. *Elaeocarpus oblongus* sensu Sm. in Rees Cyclop. **12**: no. 2. 1809 is the very different *E. robustus* Roxb. = *E. tectorius* (Lour.) Poir. as I have determined by an examination of a very excellent photograph of the *Buchanan* specimen in Smith's herbarium on which his description was based. *Elaeocarpus oblongus* Wall. List no. 2677 (sphalm. 2676), 1832, *nom.*; C. Muell. Anot. Fam. Elaeocarp. 19. 1849, *descr.*, is a synonym of *E. floribundus* Blume; both authors overlooked Gaertner's earlier use of the same epithet for a different species.

It is noteworthy that in most of the published descriptions of *Elaeocarpus* species that data regarding the fruits are very few and generalized. As Corner has pointed out for the species of the Malay Peninsula there are some very excellent differential fruit (endocarp) characters available; these have too generally been overlooked by those who have described new species and those who have assembled the data in the form of descriptive floras. Certain problems are involved in matching flowering specimens against fruiting ones or the same species in some cases.

Elaeocarpus sphaericus (Gaertn.) K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 3(6): 5. 1890; Corner, Gard. Bull. Straits Settl. 10: 326. 1939.

Ganitrus sphaericus Gaertn. Fruct. **2**: 271. *pl. 139. fig. 6.* 1791.
Elaeocarpus ganitrus Roxb. Hort. Beng. 42. 1814, *nom.*; G. Don, Gen. Hist. **1**: 559. 1831, *descr.*; Roxb. Fl. Ind. ed. 2, **2**: 592. 1832, *descr. ampl.*

This is the conventional synonymy of the species, accepted by common consent. It is possible that what now passes for a single species may be subdivided, when, on the basis of abundant material, a critical monographic treatment of the group is prepared; or it may be that the final results will be the reduction of a considerable number of additional species, thus greatly increasing the synonymy particularly in binomials proposed within the present century. If one elects to accept the principle of a collective species here, as did Corner, the problem is simply and easily solved. However there is a considerable variation in the size of the fruits and of their globose bony endocarps, and in the length of the sepals and of the petals; and yet, with Gaertner's original type a detached fruit only, there is no way of actually proving that Roxburgh's species is specifically identical with the earlier one of Gaertner; this is the reason why I accept the identity of the two as "by common consent." Gaertner's figure shows the stone, assuming his illustration to be of natural size, as about 15 mm. in diameter; those of *Ganitrus* Rumph. Herb. Amb. 3: 160. *pl. 101.* 1743, cited by both Roxburgh and Gaertner, of which he depicts

three sizes *majus*, *medium*, and *minimum*, are respectively 20, 15, and 10 mm. in diameter; and the Rumphian illustration was prepared in the last decades of the 17th century. Gaertner's material was received from Hermann, no locality indicated; from the synonymy as given by him the references to Burman and to Linnaeus must be eliminated, as these belong with the very different *E. serratus* Linn. There are striking differences in the flower sizes and in the length of the petals, as well as in fruit sizes in this *E. sphaericus* complex. With only limited material at my disposal I have not been able, except in a few cases, to associate fruit with flower sizes; the differences in vegetative characters are not great. No matter what name has been applied to this or that form, under the assumption that distinct species are represented, all the specimens examined appertaining to all the species mentioned below are very similar in general appearance.

The various authors concerned with the flora of India are in agreement that the tree is native of certain parts of that country; but it is also occasionally planted. In fact Roxburgh's material, received by him in 1809, was taken from a planted tree in Dacca, east of Calcutta. Ridley and Burkill were of the opinion that the species was not native of the Malay Peninsula, but Corner provides rather convincing evidence that it may be indigenous as he cites various places where the tree was found in the high forest with every indication of its being native there. He further stated that cultivated specimens were distinctly rare because the plant was not known to the Malays who had no use for it. This last statement is opposed to that of Watt in 1890, repeated by Cooke in 1901, to the effect that the hard stones, prized for making rosaries in India, were imported from Singapore where the tree was said to be common. This discrepancy is easily explained. As one looks into the early literature it becomes at once evident that there was, from early times, a well developed commerce between parts of Malaysia and India in the bony globose endocarps. Rumphius was familiar with this commerce more than two and a half centuries ago. One surmises that this commerce was of ancient origin, commencing some time after the Indian peoples colonized and controlled Malaysia, perhaps a thousand or even fifteen hundred years ago. After Singapore was established, in the early decades of the last century, it apparently became a port of trans-shipment for this ancient commercial product. Even in recent times Burkill notes that the Indian people resident in the Malay Peninsula gather the hard stones to take home with them on their return to India, explaining that the stones in strings of 101 represent the hundred and one eyes of Shiv. This trade is considered in some detail by Heyne, Nutt. Pl. Nederl. Ind. ed. 2, **2**: 1013. 1927.

I note that Christophersen, in recording the species from Samoa, Bishop Mus. Bull. **154**: 18. 1928, states that its habitat and distribution there suggest a recent introduction, and he further mentioned the fact that the fruit was a food favored by pigeons, inferring that the species has been, or will be spread through their agency. If Christophersen's identification

be correct, the species must be an introduced one in Samoa. Is it not possible that this same combination of factors may apply both in the Malay Peninsula and in India in view of the fact that there has been an extensive importation of the stones from Malaysia into India for many centuries, and that the tree is planted in both the Peninsula and in India? This may explain some of the petal variation mentioned by Corner, in that perhaps some of the forms now occurring in the Malay Peninsula may have been grown from seeds introduced from various parts of the Archipelago.

With the above digression I now return to the problem of synonymy. Corner stated that Malay Peninsula specimens that he examined showed great variation in the size of the petals, citing about 15 individual collections, none of which I have seen. Some had petals about 12 mm., others 8–9 mm., and still others 6–7 mm. long. I assume that these variations were on separate specimens. Because of this situation he interpreted the species as a collective one, and reduced to it the small-flowered (petals 5 mm. long), high-altitude Philippine *E. subglobosus* Merr. I judge, but have not been able to prove the point, that *E. ganitrus* Roxb. was a form with small or medium flowers, in spite of Roxburgh's artist having grossly exaggerated the size of the flowers; see Wight's reproduction of this plate. If Corner be correct, and this may well prove to be the case, then it seems to me that a very considerable number of additional reductions should be made, and in extreme cases the petal length will be as much as 15 mm. A range from 6 mm. to 15 mm. in petal length within the limits of a single species of this genus impresses me as a bit strange, although perhaps it is not impossible. Involved here is the Javan *E. angustifolius* Blume (1825), petals about 12 mm. long; *Aceratium ganitri* Hassk. (1842), which was published as a new name for Blume's species; and *E. cyanocarpus* Maing. (1874), Malay Peninsula, petals about 8 mm. long. The reduction of all of these to the synonymy of Gaertner's species is currently accepted. In more recent times we have the Moluccan *E. rumphii* Merr. (1917), petals about 11 mm. long; *E. wenzelii* Merr. (1914), petals 7 mm. long; *E. dolichopetalus* Merr. (1914), petals 15 mm. long; *E. ramiflorus* Merr. (1915), petals 5–6 mm. long; *E. subglobosus* Merr. (1909), petals 6 mm. long; and *E. baclayensis* Elm. (1911), its flowers not definitely known, reduced by me to *E. subglobosus* Merr., these last five all from the Philippines; and finally the Malayan *E. major* (Hochr.) Knuth (1941) (*E. sphaericus* var. *major* Hochr. 1904), its petals 13 mm. long. Van Steenis, Bull. Jard. Bot. Buitenz. III. 17: 409. 1948, following Corner, reduced *E. subglobosus* Merr. to *E. sphaericus* (Gaertn.) K. Schum., and accepted my reduction of *E. baclayensis* Elm. Neither Corner nor Van Steenis suggested the reductions of any of the other recent species. The extreme form *E. trichopetalus* Merr. & Quis. is so strikingly distinguished by the indumentum of both surfaces of its petals, and especially by the densely arranged retrorse hairs on the inside, that no matter what the ultimate disposition of the other proposed species may be, I do not think that the reduction of the latter is indicated; and

yet, on the whole, it is otherwise very similar to *E. sphaericus* (Gaertn.) K. Schum.

In passing I merely mention a fact that King had already noted that Roxburgh's artist at Calcutta used too much imagination in preparing the drawing of the species, reproduced by Wight, grossly exaggerating the size of the flowers, the width of the petals, and the number and length of the fimbriae of the latter. This drawing was copied, natural size, by Wight, and was reproduced by him, Ic. Pl. Ind. Or. 1: *pl. 66*. 1838. Nothing corresponding to this illustration, as to some of its floral details, exists in nature.

While this discussion has not provided much data as to the limits of the species involved, it has, I believe, pointed out certain problems for future workers to consider. From the standpoint of economic botany, I suspect that the uses of the bony endocarps in India and elsewhere, the apparently ancient commerce in them, and the prevalent beliefs in the potency of the rosaries, bracelets, and other artifacts made of these stones, the high values associated with certain types of small stones, and those which are aberrant in the number of cells (less or more than the normal 5 cells) would make a distinctly interesting study, to say nothing of religious and ethnological connotations.

EXCLUDED SPECIES

Elaeocarpus is such a strongly marked group that early workers made few errors in interpretation of such material as they had before them. These errors, where species of other families than the Elaeocarpaceae are involved, were probably due largely to attempts being made to classify incomplete specimens. The few cases where it does appear to be desirable to place reductions on record are as follows:

ELAEOCARPUS COPALLIFERUS Retz. Obs. 4: 27. 1786 = **Vateria copallifera** (Retz.) Alston in Trimen, Handb. Fl. Ceyl. 6: 26. 1931 (*Vateria acuminata* Hayne, Arzenik. 11: 5. 1830). Ceylon (Dipterocarpaceae).

ELAEOCARPUS ? DEPLANCHEI Brongn. & Gris, Bull. Soc. Bot. France 10: 477. 1863 = *Hemicyclia deplanchei* Baill. ex Guillaumin Ann. Mus. Colon. Marseille II. 9: 224. 1911, Arch. Bot. (Viguier), Mém. 2: 26. 1928 = **Drypetes deplanchei** (Brongn. & Gris) comb. nov. New Caledonia (Euphorbiaceae).

The original short and very incomplete description was based on a fruiting specimen from New Caledonia. Baillon first recognized the error involved in placing the species under *Elaeocarpus*. Guillaumin in 1911 cited six collections, and in 1928 added four more. He followed the Bentham and Hooker system in recognizing *Hemicyclia* Wight and Arnott (1833) as a valid genus. Pax and Hoffman, who monographed the group in 1922, Pflanzenreich 81(IV. 147. XV): 229–279, reduced *Hemicyclia* to *Drypetes* Vahl, recognizing a total of 138 species in the tropics of both hemispheres. The present species is known only from New Caledonia.

ELAEOCARPUS ? INTEGRIFOLIUS Blanco, Fl. Filip. ed. 2, 306. 1845, non Lam. (1788) = *Urandra luzoniensis* Merr. Philip. Jour. Sci. 3: Bot. 242. 1908, Sp. Blancoanae 237. 1918 = **Gomphandra luzoniensis** Merr. Enum. 2: 490. 1923 (*Stemonurus luzoniensis* Howard, Jour. Arnold Arb. 21: 468. 1940), Philippines (Icacinaceae).

Whether *Gomphandra* Wall. or *Stemonurus* Blume be selected as the proper generic name for this form depends on which species one chooses as the type of *Stemonurus* Blume. He included representatives of two distinct genera (*Gomphandra* and *Stemonurus*) in his treatment of *Stemonurus*.

ELAEOCARPUS INTEGRIFOLIUS Sieb. ex Presl, Oken, Isis 21: 273. 1828, pro syn. *Ochna integrifolia* Presl, l.c., ex descr. = **Ochna mauritiana** Lam. Encycl. 4: 512. 1798. Mauritius (Ochnaceae).

ELAEOCARPUS ? PUNCTATUS Wall. List no. 2676. 1830, *nom.* = **Parinarium costatum** (Korth.) Blume, Mélang. Bot. — 1855; Miq. Fl. Ind. Bat. 1: 354. 1855; Flora 41: 255. 1858 (*Lepidocarya costata* Korth. Nederl. Kruidk. Arch. 2: 285. 1855). Singapore (Rosaceae).

The reduction of Wallich's undescribed species is on the authority of King, Jour. As. Soc. Bengal 66(2): 277. 1897 (Mater. Fl. Malay. Penin. 3: 277). Blume's "Mélanges botaniques" is apparently quite unknown to modern botanists, and possibly was never actually "published." A summary of its contents appears in Flora 41: 254–256. 1858, these data apparently taken from a set of proof sheets.

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STUDIES IN THE BORAGINACEAE, XXI
SINO-INDIAN SPECIES OF ONOSMA

IVAN M. JOHNSTON

THE GENUS ONOSMA has its center of distribution, greatest diversity, and maximum concentration of species in Iran and westward into Syria and Turkey. Over seventy of the 128 species of *Onosma* recognized in the enumeration by Stroh, Beih. Bot. Centralbl. 15[B]: 430–454 (1939), occur in that area. Eastward of its center the genus is represented by two groups of species. One occurs from Turkestan northeastward to the Altai. Its species are conventional members of the genus and most have evident affinities with species in the Near and Middle East. The other group, a more southerly one, occurs across northern India and adjacent Tibet into Burma and China. Among its members are the most southerly and most easterly ranging species in the entire genus. Its western members, those found in Baluchistan, Afghanistan, and adjoining India, may have evident Iranian affinities, but those ranging east of Kashmir have none. In its migration eastward from its center, across northern India to China, the genus has been confined to a narrow band of territory. Isolated, subjected to high altitudes, and influenced by monsoonal climate, its representatives there have been modified and become very distinct species, some with peculiarities of habit and structure unknown elsewhere. The present paper is primarily concerned with this distinctive group of species. In order that the treatment be given wider usefulness, however, it has been expanded into a regional treatment, and all species of *Onosma* from western India and eastern Afghanistan and Baluchistan included also. "India" has been used as a geographical rather than a political term and has been applied to all of the former, continental British India exclusive of Baluchistan and Burma.

In the past the species of *Onosma* have been distinguished almost exclusively by external features of the plant, with general habit, indument and size and shape of the flowers most emphasized. In general, though the differences that have been used are real, they are of a sort difficult to express in precise terms. Published accounts of the genus, as a result, have been far from satisfactory as a means of identifying species. It has

been surprising to discover, therefore, that the stamens and other structures inside the corollas of *Onosma* show wide differences between species and, though previously totally ignored, provide numbers of precise, very usable characters for distinguishing species. Their usefulness is illustrated in the subjoined account of the Sino-Indian species. Among most of these species an examination of the corolla is all that is needed for precise identification.

The useful characters found on the inner surface of the corolla are those involving the distribution of any hairs that may be present, the height above the corolla-base and nature of the filament-attachment, and the size, form, and indument of the suprabasal appendage known as the nectary. The stamens also show considerable diversity from species to species. The filaments differ in length, shape, and nature of attachment, in presence or absence of pubescence, and, when developed, in size and shape of their decurrent base. The anthers are also diverse. In some species they are free from one another, in others they are coherent at the base only, and in still others they are firmly joined laterally as well as basally and form a tube. They may be completely included in the corolla or protrude from the mouth to various degrees. Between different species they differ also in length, in height of attachment to filament, in nature of the connective, in shape of base, in size and shape and margin (presence or absence of denticulations) of the sterile tip. In some species tendencies towards zygomorphy are evident. This is very clear in *O. multiramosum*. In that species the corolla is slightly bilabiate, and the anther-tube is unilaterally curved. In species such as *O. Farrerii*, *O. Thomsonii*, and relatives of *O. lycopsioides*, and I suspect in less degree in other species also, asymmetry is revealed by differences in the attachment among the five stamens within the flower. In these two filaments are transversely, two are obliquely attached, and the fifth, odd filament is vertically attached to the corolla, all at the same distance above the corolla-base. The style is generally uniform. In a few species, however, it is characteristically hairy below the middle.

For use in the present study I have had the privilege of receiving on loan specimens from the Gray Herbarium (G), New York Botanical Garden (NY), United States National Herbarium (US), Missouri Botanical Garden (Missouri), University of California at Berkeley (UC), Royal Botanic Garden, Kew (K), Royal Botanic Garden, Edinburgh (Ed), and Forest Research Institute, Dehra Dun (DD). The loans from Edinburgh and Dehra Dun have been of special value and usefulness because of the very large number and high critical value of the specimens they contained.

KEY TO THE SPECIES

Anthers united laterally as well as basally, forming a tube.

Anthers included in the corolla or with only tips extruded.

Filaments and style hairy (hairs 0.3–0.7 mm. long); stems arising singly from a biennial root, bearing a panicle of cymes; southwestern China.

Plant with distinctly hirsute stems and leaves; middle cauline leaves 1–2 cm. broad; reduced uppermost leaves very abruptly expanded at base and usually somewhat sagittate and amplexicaul.....1. *O. paniculatum.*

Plant with scanty short inconspicuous bristles on stem and leaves; cauline leaves 3–4 cm. broad; reduced uppermost leaves triangular-ovate, scarcely if at all amplexicaul.....2. *O. oblongifolium.*

Filaments and style glabrous or (in no. 8) at most microscopically puberulent; stems usually several from a perennial root.

Nectary glabrous; western India.

Filaments short (2–2.5 mm. long), base of anther about opposite base of filament.....3. *O. chitralicum.*

Filament longer (5–10 mm. long), base of anther 2–6 mm. above base of filament.

Plant with a strong perennial root; stems 1–7.5 dm. tall; basal leaves 10–40 cm. long, 5–15 mm. broad; Kumaon to Chitral.....4. *O. hispidum.*

Plant with biennial or short-lived root; stems 1–3 dm. tall; basal leaves 4–10 cm. long; Chitral to Baluchistan.

Bracts of inflorescence with slender decidedly attenuate tips; corolla 30–32 mm. long; filaments 9–10 mm. long.....5. *O. khyberianum.*

Bracts of inflorescence acute, not noticeably slender-attenuate; corolla 22–30 mm. long; filaments 6–9 mm.

Middle stem-leaves 3–7 mm. broad, hairs on upper surface more or less antrorsely appressed; corolla 22–25 mm. long; Baluchistan.....6. *O. barbigerum.*

Middle stem-leaves 8–15 mm. broad, hairs on upper surface erect; corolla 25–30 mm. long.....7. *O. Griffithii.*

Nectary villose.

Filaments arising at or near middle of corolla, decurrent base linear, about as high as broad, farinose-puberulent; corolla 14 mm. long, very minutely puberulent outside; Tibet.....8. *O. Waltoni.*

Filaments arising distinctly below the middle of corolla, the decurrent base oblong or lanceolate, broader than high or higher than broad, not farinose-puberulent.

Cymes coarse, 4–5 cm. broad; filaments borne 6.5 mm. above corolla-base; anthers 10 mm. long; corolla 19.5 mm. long, evidently strigose outside; calyx at anthesis 12–17 mm. long; n. w. Yunnan.....9. *O. Wardii.*

Cymes 1–4 cm. broad; filaments borne 3–4.5 mm. above corolla-base; anthers 5–8 mm. long; corolla 10–18 mm. long.

Stems 3–10 dm. long, erect, arising singly; cymes borne terminal on main stem or on numerous slender peduncles from the upper axils, hence displayed in an elongate panicle; middle cauline leaves 4–12 cm. long; corolla 13–18 mm. long, evidently strigose outside; calyx at anthesis 9–12 mm. long; s. w. China.....10. *O. confertum.*

Stems 1–3 dm. long, erect to decumbent, usually several rising together, producing major terminal cymes and later smaller

cymes in many of the leaf axils, the aggregate inflorescence not distinctly paniculate; middle cauline leaves 2–5 cm. long; corolla 10–15 mm. long, outside puberulent and on and below the lobes, also hispidulous; calyx at anthesis 5–7 mm. long; Tibet.....19. *O. Waddellii.*

Anthers more than half exserted, commonly almost completely so.

Base of filaments and adjacent corolla-tube villose.

Leaves obviously broadest at or above middle, gradually attenuate towards the very narrow acute or even subpetiolate base; plant with very slender loosely branching stems; China.....11. *O. sinicum.*

Leaves broadest at or near base.

Plant robust, flowering stems coarse, 3–5 mm. thick; filaments subulate, broadest at the very base; Burma....12. *O. burmanicum.*

Plant with clusters of slender erect simple flowering stems 2 mm. or less thick; filaments broadest (0.5–0.7 mm.) a short distance (0.5–1 mm.) above base, hence perceptibly narrowed just above the attachment; n. w. Himalaya....13. *O. hypoleucum.*

Base of filament and adjacent corolla-tube not villose.

Stems coarse, usually 5–12 mm. thick near base, rising singly from a stout biennial root, more than 6 dm. tall, usually reaching a meter or more; China.

Anthers becoming completely exserted; corolla-throat 4.5–5 mm. thick, inside hairy below the lobes; calyx and pedicels strigose with stout short hairs less than 1 mm. long; anthers 5.5–6.5 mm. long; sterile tip 0.5–1 mm. long.....14. *O. exsertum.*

Anthers only half exserted; corolla-throat 8–10 mm. thick, glabrous inside; calyx and pedicels villose-hispid, the hairs mostly spreading and 1–3 mm. long; anthers 7–8 mm. long, sterile tip 1.5–2 mm. long.....15. *O. fistulosum.*

Stems more slender and shorter, usually several rising together from the root.

Tip of anthers and tip of flower-bud becoming curved to one side; China.....16. *O. multiramosum.*

Tip of anthers and tip of flower-bud straight or nearly so.

Base of filament and adjacent portions of corolla-tube papillate and glanduliferous; base of filament not decurrent. China.....17. *O. adenopus.*

Base of filament and adjacent corolla neither papillate nor glanduliferous (decurrent base of filament sometimes papillate in no. 19).

Style hairy below middle; corolla-throat abundantly hairy inside; anthers 9–10.5 mm. long, sterile tip 2.5–3 mm. long.....18. *O. album.*

Style glabrous; corolla-throat glabrous or with only inconspicuous lines of hairs below the lobes; anthers 4–8.5 mm. long, sterile tip 0.3–2 mm. long.

Filaments with a prolonged elevated decurrent base 2.5–3 mm. long; corolla-throat 5–8 mm. broad, inside frequently bearing a line of hairs below each lobe; plant not developing a shrubby caudex; Tibet.....19. *O. Waddellii.*

Filaments not decurrent, with transverse arcuate attachment; corolla-throat narrow, 3–5 mm. thick, glabrous inside; base of stems persisting and forming a loose fruticulose caudex.

Middle cauline leaves oblanceolate; corolla blue, outer surface with antrorse hairs; China.....20. *O. Farrerii.*

Middle cauline leaves lanceolate; corolla white, outer surface with mostly retrorse hairs; n. w. Himalayas.....21. *O. Thomsoni.*

Anthers united only at the very base.

Calyx divided into narrow, very elongate, linear or linear-lanceolate lobes; lobes many times longer than broad.

Corolla shorter than calyx-lobes or at most equaling them; bracts lanceolate, with excessively prolonged tips; lower leaf-face evidently veined, clothed with a pallid indument of abundant minute hairs; western Himalaya (Kumaon).....22. *O. bracteatum.*

Corolla evidently surpassing the calyx-lobes; bracts lanceolate or subulate, tips acute.

Filaments attached at or above middle of corolla; corolla 16–33 mm. long.

Corolla blue or red, outer surface with abundant evident appressed hairs; nectary villose; anthers 5.5–9 mm. long, sterile tip ca. 0.5 mm. long; plant 1–3 dm. tall, perennial; eastern Himalaya and Tibet.....23. *O. Hookeri.*

Corolla yellow, outer surface glabrous or nearly so; nectary glabrous; anthers 9–12 mm. long, sterile tip 1–1.5 mm. long; plant 2.5–10 dm. tall, biennial; Afghanistan, Baluchistan and adjacent India.....24. *O. dichroanthum.*

Filaments attached distinctly below the middle of the corolla.

Filaments thickened and conspicuously villose just above the base, 5–6 mm. long, attached 1.7–2.5 mm. above corolla-base; corolla barrel-shaped, red, broadest near middle, 11–13 mm. long; anthers 4–4.5 mm. long; Kumaon.....25. *O. pyramidale.*

Filaments not thickened nor hairy above the base; corolla gradually expanding from the base, broadest at or near the level of the lobes, pink to purple.

Corolla twice as long as the calyx-lobes, 16–17 mm. long; filaments 4–5 mm. long, attached 5–6 mm. above base of corolla; anthers 7–7.5 mm. long; western China.....26. *O. mertensioides.*

Corolla about once and a half the length of calyx-lobes, 7–17 mm. long.

Plant 1–3 dm. tall; stems simple or producing a few coarse cymes in the upper axils; corolla minutely hispidulous or villulose or nearly glabrous outside; nectary sparingly hairy or nearly glabrous; filaments 1.5–6.5 mm. long, attached 3–8 mm. above corolla-base; anthers 2.5–6.5 mm. long; Afghanistan, Baluchistan and adjacent India.....27. *O. limitaneum.*

Plant 5–15 dm. tall; stems with very numerous floriferous branches; corolla evidently and abundantly appressed villose outside; nectary densely villose; s. w. China.

Stems very bristly, tawny hispid; style and decurrent base of filaments glabrous; filaments 2–2.5 mm. long, attached 2–2.5 mm. above corolla-base; anthers 4–4.5 mm. long. . . . . 28. *O. cingulatum.*

Stems sparingly bristly, cinereous; style below middle and decurrent base of filaments sparingly hairy; filaments 4 mm. long, attached 3.5 mm. above corolla-base; anthers 5.5 mm. long. . . . . 29. *O. Tsiangii.*

Calyx with a broad shallow tube and cuneate or narrowly triagular lobes; lobes gradually narrowed from the broad base, 1.5–3 times longer than broad.

Corolla 14–18 mm. long.

Corolla above middle minutely verruculose; Nepal. . . . . 30. *O. verruculosum.*

Corolla not verruculose, firmer; Assam and s. w. China.

Leaves mostly with stiffish appressed hairs 1–2 mm. long; plant drying light in color. . . . . 31. *O. Borii.*

Leaves with more slender spreading hairs 2–3 mm. long; plant noticeably darkening in drying.

Cauline leaves with obtuse or acute base, moderately hairy. . . . . 32. *O. lycopsioides.*

Cauline leaves abruptly rounded at very base, abundantly hairy. . . . . 33. *O. microstoma.*

Corolla 9–12 mm. long.

Filaments 5 mm. long; corolla yellow; Yunnan. . 34. *O. dumetorum.*

Filaments 1–2.5 mm. long; corolla blue or purple.

Root stout, strong, perennial, 5–15 mm. thick. . . . . 35. *O. emodi.*

Root weak, slender, annual or at most biennial, 0.5–2 mm. thick.

Corolla 1–1.5 times longer than broad, broadly ovoid, with puffed-out ribs conspicuously protruding between the calyx-lobes. . . . . 36. *O. Wallichianum.*

Corolla twice longer than broad, barrel-shaped, ribs weakly protruding between the calyx-lobes.

Hairs of foliage single, none stellately arranged. . . . . 37. *O. bicolor.*

Hairs stellately arranged on leaf, at least on the upper surface. . . . . 38. *O. egregium.*

1. **Onosma paniculatum** Bureau & Franchet, Jour. de Bot. **5**: 104 (1891); Handel-Mazzetti, Symb. Sinicae 7²: 816 (1936). — Type from the vicinity of Tatsienlu, *Bouvalot & d'Orleans.*

Onosma paniculatum var. *hirsutistylum* Lingelsh. & Borza, Repert. Sp. Nov. **13**: 389 (1914). — Type from mountain slope between Yo-tsai and Kwang-dung on road from Yunnan to Tsuyung, *Limpricht 966.*

Plant biennial or rarely perennial, darkening in drying, with a stout dye-stained taproot; stems single, 3–12 dm. tall, 5–10 mm. thick towards the base, sparingly hispid (hairs spreading, 1–4 mm. long, bulbose-based) and abundantly and usually retrorsely hispidulous or villulose (hairs 0.1–0.5 mm. long), producing pedunculate cymes from the upper axils but otherwise unbranched; leaves appressed hispid (hairs 2–4 mm. long,

arising from discoid bases) and sparingly villulose or hispidulose on the upper surface, lower surface abundantly hispidulous or villulous and sparingly and inconspicuously hispid; lower leaves 10–20 cm. long, 1–3 cm. broad, oblanceolate with a winged petiole; cauline leaves gradually reduced up the stem, lanceolate, 1–2 cm. broad, those above the middle sessile, broadening above the base and becoming somewhat sagittate and even somewhat amplexicaul; cymes mostly simple, very numerous, terminal on the main stem and arising on leafless peduncles 3–10 cm. long from many of its upper axils, hence paniculately displayed, at anthesis 2–4 mm. broad, in fruit elongating and unilaterally racemose, 5–10 cm. long; larger bracts more or less sagittate, smaller bracts lanceolate or subulate; calyx hispid and strigulose, 5–14 mm. long, not much accrescent in fruit; pedicels slender, straight, 5–20 mm. long; corolla red or pinkish red changing to violet and blue, 12–17 mm. long, from a base 2.5–3.5 mm. thick gradually expanding upwards, 8–10 mm. thick at level of sinus, outside abundantly antrorse-strigulose, inside strigulose on throat below each corolla-lobe; lobes broader than long, margin revolute; anthers included or with only tips exserted, coherent basally and laterally to form a tube, 6–8 mm. long, base borne 6–8 mm. below level of corolla-sinus, filament-attachment 1–1.7 mm. above base; filaments 3–4.5 mm. long, evidently villulose, from a decurrent base 1 mm. long and 0.4–0.8 mm. wide gradually narrowed upwardly, arising 3–4.5 mm. above corolla base; nectary about 0.5 mm. high, lobed, densely villose; style 15–18 mm. long, lower two-thirds appressed hairy; nutlets 2 mm. long, dull, verrucose.

Southwestern China, from central Sikang south in the highlands to Yunnan and adjacent Kweichow; also in Bhutan.

SIKANG: betw. Yenyuan and Hunka, 2800 m., *Schneider 1481* (E); Huei-li Hsein, grassy place on mountain slope, 2800 m., plant 3 ft. tall, fl. pinkish red, *T. T. Yü 1525* (G); near Tatsienlu, *Bouvalot & d'Orleans* (G, frag. of type).

YUNNAN: Mengtze, 6500–7000 ft., fl. red with bluish tinge, *Henry 9334A* (NY, Ed); east base of Tali Range, open stony pasture land, plant 2–4 ft. tall, fl. deep rose-purple, 6700–8000 ft., *Forrest 4472* (Ed); in monte Lautsching in dist. Yunnan-fu, in rupibus calcar., fl. rubescentibus, alt. 2200 m., *O. Schoch 225* (US); Ahsi, northwest Likiang Snow Range, open hillsides, pl. 3 ft., fl. rose-purple and rose-blue, *R. C. Ching 20781A* (G); Likiang, 2950–3100 m., fl. red becoming blue, *Handel-Mazzetti 4164* (G); Likiang plain, lat. 27°20′, plant 2–4 ft., fl. rose changing to blue, dry open situations, 8500 ft., *Forrest 6085* (Ed); east flank of Likiang Range, lat. 27°12′, dry stony open situations in pine forest, 9000–10500 ft., plant 1.5–2.5 ft. tall, fl. at first rose-purple then blue, *Forrest 2447* (Ed); Chin Hai Tze, east slope Likiang Snow Range, alpine meadow, 11000 ft., fl. red and blue, *Rock 4441* (G, US, Ed); Tungchwan, fl. pink becoming blue, 2600 m., *Maire* (G, US, Ed); north flank Haba Snow Range, dry open pine forest, plant 2–3 ft. tall, fl. flushed purple and blue-purple, *K. M. Feng 1319* (G); inter Lanticho et Poloti, reg. Yungning-Yingpeh, fl. obscure purp., June 29, 1914, *Schneider 1682* (US).

KWEICHOW: Weining, open hillside, fl. red, *Y. Tsiang 9108* (NY).

BHUTAN: Lingtsi to Kurmed, sandy soil under *Pinus longifolia*, 6000 ft., fl. red and blue, July 24, 1915, *R. E. Cooper 4176* (Ed); Re-Teng to Tsaza-La, 8175–9125 ft., July 2, 1938, *B. J. Gould 742* (K, DD).

TIBET: upper Chumbi Valley, 12000 ft., Sept. 1938, *B. J. Gould 1577* (K).

This is the most widely distributed and the most frequently collected of the Chinese species of the genus. It is very distinct, readily recognizable and has its closest relative in *O. oblongifolium*. In producing a single tall flowering stem from a stout biennial root, it has a growth habit shared by several other species in southwestern China, namely *O. oblongifolium*, *O. album*, *O. exsertum*, and *O. fistulosum*. *Onosma confertum* has a somewhat similar appearance but its root can be persistent and may produce more than a single stem each season. A very unusual feature of our plant is its sagittate uppermost leaves. These are a very useful aid in recognizing it.

2. **Onosma oblongifolium** W. W. Smith & Jeff. Notes R. Bot. Gard. Edinburgh 9: 113 (1916). — Type from bend of Yangtse, lat. 27° 45′, Yunnan, *Forrest 11198*.

Plant biennial, producing a single erect stem 7.5 dm. tall; stem 7 mm. thick towards base, above middle producing leafless floriferous branchlets 5–15 cm. long, abundantly hispidulous, the minute hairs retrorse 0.5–1 mm. long mostly with a thickened base; leaves green, scabrous, ample, gradually reduced up the stem, minutely hispidulous, on upper surface also with scattered short bristles arising from discoid bases; basal leaves unknown; middle cauline leaves sessile, narrowly oblong, 12–14 cm. long, 30–38 mm. broad, broadest at or just above the middle, base abruptly contracted, obtuse, apex obtusish; upper cauline leaves oblong-lanceolate to triangular-ovate, broadest just above the truncate or abruptly rounded and subamplexicaul base; cymes numerous, terminal and on peduncles arising from many of the uppermost axils, hence paniculately displayed, in fruit unilaterally racemose, 5–7 cm. long; bracts ovate to acute, broadly attached; calyx 10–12 mm. long, not much accrescent in fruit; hispidulous and sparingly bristly below middle; pedicels slender, 5–13 mm. long; corolla "bluish rose," 13–15 mm. long, from a base 2.5 mm. thick gradually expanded, becoming 8.5 mm. thick just below the sinus, outside above middle abundantly and antrorsely appressed villulose, throat inside strigose along a line below each corolla-lobe, lobes broader than long, margin revolute; anthers 7–8 mm. long, coherent basally and laterally to form a tube, base borne 6–8 mm. below level of corolla-sinus, attached to filament 1.5 mm. above base; filaments abundantly short villulose, from a decurrent base 1 mm. long and 0.5 mm. broad gradually narrowed upward, 4.5–5 mm. long, arising 2.5–3 mm. above corolla-base; nectary narrow, lobed, less than 0.5 mm. broad, villose; style 15–16 mm. long, appressed hairy; nutlets brown, opaque, 2.5–3 mm. long tuberculate obscurely pitted.

CHINA (northern Yunnan): mountains in the north of the Yangtse bend, 10000 ft., lat. 27°45′, open stony pasture, plant 2–2.5 ft. tall, fl. bluish rose, *Forrest 11198* (TYPE, Ed).

A very well marked species evidently related to *O. paniculatum*. Especially distinctive of the species are its broad leaves and its scanty indument in which the coarser components are reduced in size and comparatively sparse and inconspicuous. Compared with *O. paniculatum* the plant appears more luxuriant, glabrescent, and greener.

3. **Onosma chitralicum**, sp. nov.

Planta hispidissima (pilis patentibus 1–2 mm. longis) et abundanter minuteque hispidula (pilulis 0.1–0.2 mm. longis); caulibus infra medium ignotis, ad 4 mm. crassis, simplicibus vel solum apicem versus ramulo axillari 5–10 mm. longo sparse foliato floriferi donatis; foliis caulinis medionalibus lanceolatis crassiusculis acutis 2.5–4.5 mm. longis 3–8 mm. latis; cymis furcatis maturitate laxe racemosis 10–13 cm. longis; calyce sub anthesi 8–10 mm. longo 3–5 mm. longe graciliterque pedicellato lobis anguste lanceolatis 1–1.5 mm. latis villoso-hispidis; calyce fructifero 10–12 mm. longo ad 8 mm. longe pedicellato, lobis ad 2 mm. latis rigidis; corolla 12–14 mm. longa a basi ad 2.5 mm. crassa sursum gradatim ampliata apicem versus 4–4.5 mm. crassa, extus subglabra vel minutissime puberulenta, intus glaberrima, in sicco brunnea; antheris 6.5–7 mm. longis, basaliter lateraliterque cohaerentibus, tubum formantibus, 2–2.5 mm. supra basim affixis, basibus 6–7 mm. infra sinus corollae positis; filamentis linearibus, 2–2.5 mm. longis, 5–6 mm. supra basim corollae affixis; nectario glabro 0.2–0.3 mm. alto; stylo ca. 15 mm. longo; nuculis nitidis laevibus 3–4 mm. longis.

INDIA (Northwest Frontier): Chitral, *S. M. Toppin 481* (TYPE, Kew); Lowari Range, Chitral, 11000 ft., Aug. 1895, *Gatacre 17345* (DD).

A very distinct and well marked species for which I can suggest no very close relative.

4. **Onosma hispidum** Wallich, Numerical List 26, sub no. 938 (1829), nomen; D. Don, Gen. Syst. 4: 317 (1838). — "native of Kamaon" *Wallich 938*.

Onosma echioides sensu Clarke, Fl. Brit. India 4: 178 (1883); Blatter, Beautiful Flowers Kashmir 2: 60, t. 45, f. 3 (1928).

Plant perennial, bristly with spreading usually somewhat tawny hairs 2–5 mm. long, also minutely hispidulous; stems one to many, erect or ascending, simple or rarely branched, 1–5 or rarely 7.5 dm. long, 3–6 mm. thick towards base; leaves usually veinless, hispid and hispidulous on upper surface, the coarse hairs usually with discoid bases; basal leaves usually persisting at flowering time, oblance-linear to narrowly oblanceolate, 10–40 cm. long, 5–15 mm. broad, apex obtusish; middle cauline leaves linear-oblong or lance-oblong, obtusish, 4–8 cm. long, 4–10 mm. broad; cyme terminal, forked, at anthesis dense, 3–4 cm. broad, at maturity elongating, racemose, up to 15 cm. long; bracts lanceolate; calyx 12–15 mm. long at anthesis on pedicels 1–3 mm. long, lobes lance-linear, 1–2 mm. broad, tawny bristly, at maturity 15–25 mm. long on pedicels 5–10 mm. long, with lobes 1.5–3 mm. broad; corolla white, cream or pale yellow, 18–23

mm. long, from a base 3–3.5 mm. thick gradually expanding, 8–11 mm. thick just below the sinus, outside commonly sparsely hispidulous on the lobes and elsewhere very minutely puberulent, inside completely glabrous; anthers united basally and laterally to form a tube, 9–11 mm. long, attached ca. 2.5 mm. above base, tip to 2 mm. long, base held 8–11 mm. below level of corolla-sinus; filaments 5–6 mm. long, ligulate, arising 8–10 mm. above corolla base, decurrent base ad 5 mm. long; nectary a completely glabrous flange about 0.3 mm. high; style 13–23 mm. long, glabrous; nutlets 6 mm. long, smooth or obscurely roughened, somewhat lustrous.

Mountains of northwestern India, from Chitral to Kumaon.

INDIA: Seerenagur, *Kamroop in herb. Wallich* (K); above Jangla, Tehri-Garhwal, July 7, 1883,—no. *347A* (DD); Saugla, Baspa Valley, Simla Hills State, 12000 ft., fl. pale yellow, *Ludlow & Sherriff 7372* (G); Rogi Cliffs, Bashahr, 9000 ft., fl. greenish white, *Laurie 5403* (Ed, DD); Rogi in Kunawar, *Nanale* (DD); Rogee, *herb. Royle* (DD); Rong Gael, Tidong Valley, Bashahr, hot shale slopes 9500 ft., *R. M. Gorrie* (DD); Kauacharanga, Bashahr, 10000 ft.,—no. *62* (DD); Kunawar, 1885, *Drummond 22228* (UC, Ed); Chini Cliffs, Upper Kanawar, 9200 ft., *J. H. Lace 282* (Ed); Jashrang Cliffs, Bashahr, 9800 ft., fl. creamy white, *Parker 2914* (G, DD); Pricker, Lahul, 12000 ft., fl. yellow, *Bor 14852* (Ed, DD); Ganlur, Lahul, dry slopes, 10200 ft., dry slopes, fl. yellow, *Bor 15284* (Ed, DD); Dartse to Patseo, Bhaga, Lahul, *Schlagintweit 4092* (G); Dartse to Tsanskar Sumdo, *Schlagintweit 4132* (G); Lulu to Lahaul, 1888, *Drummond 22919* (UC, Ed); Kolong, Chenab Valley, Bashahr, 11000 ft., *T. R. Chand 115* (US); Pangi, Vhatwani Forest, Chamba, 9000 ft., *Harsukh* (UC); Pangim Chanba, Aug. 1880,—no. *280* (DD); Luj Forest, Chamba, 10000 ft., *Harsukh* (DD); Luj Forest to Pangi, 1897, *Lace* (Ed); Kagan Valley, Hazara, 8000 ft., *Inayat 19480* and *19481* (DD); Dis Valley, Chitral, 6000 ft., May 1895, *Gatacre 17344* (DD); Madajlast, Chitral, 10000 ft., July 1908, *Toppin 509* (K); Sai, 8000 ft., 1880, *Tanner 6* (DD); Ribe, 9000 ft., Sept. 1864, *Brandis 4137* (DD).

KASHMIR: below Traghol, 7–8000 ft., *R. R. Stewart 19438* (G); Tannin to Zojbal, 11000 ft., *J. R. Drummond 14202* (Ed); Machel, Sapphire Mines, Kishtawar, 9000 ft., open bracken-covered hillslope, fl. cream, *Ludlow & Sherriff 9124* (G); Matayan, Dras, 11000 ft., July 31, 1891, *G. A. Gammie* (DD); Chatpani nullah, west of Dras, 10–12000 ft., Aug. 27–28, 1893, *Duthie s. n.* and *13814* (DD); Joginai spur, opposite Jaodon Valley in Tilail, Kishanganga Valley, 12000 ft., 1909, *Keshavanand 1440* (DD); near Gagangir, Sind Valley, 7800 ft., June 25, 1892, *Duthie 11468* (DD); below Baltal, Sind Valley, 9–10000 ft., June 26, 1892, *Duthie 11566* (DD); Gudhai Valley, Astor Dist., 12–13000 ft., July 21, 1892, *Duthie* (DD); Kinimola nala, Liddar Valley, May 23, 1901, *Inayat* (UC).

4A. **Onosma hispidum** var. **kashmiricum**, comb. nov.

Onosma kashmirica Johnston, Jour. Arnold Arb. **21**: 50 (1940).—Type from Pan Dras, Ladak Road, Kashmir, *R. R. Stewart 10053*.

Corolla longer and proportionately more elongate than in the type form, about three times longer than broad, 28–30 mm. long; filaments longer (7–9 mm.) and affixed higher on the corolla (12–13 mm. above base).

KASHMIR: Pan Dras, Ladak Road, 10000 ft., *R. R. Stewart 10053* (G, TYPE); Tashgam, Treaty Road, Ladak, stony hillslope, fl. cream, *Ludlow & Sherriff 8340* (G); Shumkergadh, Kaminala, Astor Valley, *Inayat 25702* (DD); without locality, *herb. Falconer* (G); without locality, 5–8000 ft., *T. Thomson* (G).

This species appears to be the most common and widely distributed *Onosma* in the western Himalayas. Certainly it has been collected more frequently than any other species in our area. Though in the past usually identified with *O. echioides* L. it is not at all closely related to that species of Europe. Among the Indian species only *O. dichroanthum* has any particular relations with the latter. The immediate relations of *O. hispidum* are with *O. Gmelini* Ledb. of the Altai.

Onosma hispidum has a distinctive habit and is usually recognizable at a glance. In its area its strong root, clustered coarse stems, persisting elongate basal leaves and slightly tawny very bristly indument are distinctive. Except in parts of Kashmir, another distinctive feature is its short stout corollas, generally about twice as long as broad. A form of the species in Kashmir, however, has longer and proportionately more elongate corollas, generally about three times longer than broad. It has been distinguished as the var. *kashmiricum*. It comes from an area in which the typical form of the species has been found and differs from it only in corollas. It merits recognition only because of the uniformity of the species elsewhere over its wide area of distribution.

5. **Onosma khyberianum,** sp. nov.

Planta ut videtur perennis hispidissima et minute hispidula pilis conspicuis pallidis 1.5–4 mm. longis et pilulis inconspicuis 0.05–0.1 mm. longis obsita; caulibus pluribus erectis adscendentibusve 15–25 cm. longis basim versus 3–4 mm. crassis simplicibus; foliis firmis enervatis, in facie superiore basibus pilorum discoideis pallidis praeditis; foliis basalibus 4–9 cm. longis 5–9 mm. latis anguste oblanceolatis acutis obtusisve tempore florendi persistentibus; foliis caulinis superioribus ca. 4 cm. longis 5–6 mm. latis acutis; cymis solitariis terminalibus simplicibus vel rare furcatis, sub anthesi cernuis ca. 5 cm. diametro; bracteis lanceolatis ad 2.5 cm. longis et 6 mm. latis apice longe attenuatis; calyce ad anthesin 18–23 mm. longo 2–4 mm. longe pedicellato, lobis 15–20 mm. longis anguste lanceolatis apice attenuatis; corolla alba vel ochroleuca, 30–32 mm. longa, a basi 2–3 mm. crassa sursum gradatim ampliata, apicem versus 8–10 mm. crassa, extus lobis deltoideis 2.5–3 mm. latis longisque pilulis sparsis donata alibi glabra; antheris 11–13 mm. longis basaliter lateraliterque cohaerentibus tubum formantibus, 3–4 mm. supra basim affixis, basibus 5–8 mm. infra sinus corollae positis, apicibus sterilibus 1.5–2 mm. longis exsertis, connectivo tumido muriculato; filamentis 9–10 mm. longis, ligulatis, basim versus ampliatis, 13–15 mm. supra basim corollae orientibus, basi 5–6 mm. longe decurrentibus; nectario glabro lobulato 0.2–0.4 mm. alto; nuculis ad 3 mm. longis, nitidis, laevibus.

INDIA (Northwest Frontier): Khyber Pass, rocky mountains, 3700 ft.

alt., stems ascending, fl. drooping, corolla white, April 9, 1899, *H. H. Johnston 22* (TYPE, Edinburgh); Landi Kotal, rocky hillsides, 3600 ft., leaves grayish intensely bristly, fl. creamy white fading to yellow, March 30, 1942, *D. L. 709* (Ed).

Distinctive of the species are its slenderly attenuate bracts, very elongate corollas, and large handsome nodding cymes; all characters readily separating it from its closest relative, *O. Griffithii.* The two specimens cited are both from Khyber Pass. Possibly it may occur also in Chitral. An incomplete specimen at Dehra Dun (*Gatacre 17343* from 7000 ft. in Baraul Valley) possibly is conspecific. It differs from the type form in having acute, rather than attenuate bracts, as well as in its somewhat tawny, rather than pale, indument.

6. **Onosma barbigerum,** sp. nov.

Planta ut videtur biennis hispidissima et minute hispidula pilis conspicuis gracilibus pungentibus 3–5 mm. longis cinereis et pilulis inconspicuis patentibus abundantibus 0.05–0.1 mm. longis donata; caulibus pluribus, erectis vel adscendentibus, simplicibus, 1.5–4 dm. longis, basim versus 4–7 mm. crassis; foliis viridibus, hispidis, haud vel vix nervatis, in facie superiore basis pallidis discoideis pilorum notatis; foliis basalibus oblanceolatis, 8–16 cm. longis, 8–17 mm. latis, apice acutis obtusisve; foliis caulinis medionalis oblongis vel elliptico-oblongis, 3–5 cm. longis, 8–14 mm. latis; cymis terminalibus, simplicibus vel furcatis, sub anthesi 4–6 cm. latis, maturitate elongatis racemosis 8–12 cm. longis; bracteis lanceolatis; calyce sub anthesi 15–20 mm. longo 1–3 mm. longe pedicellato, maturitate 18–23 mm. longo, 2–6 mm. longe pedicellato, lobis linearibus vel lineari-lanceolatis; corolla 22–25 mm. longis, a basi 2–3 mm. crassa sursum gradatim ampliata, infra sinus 7–9 mm. crassa, extus lobis deltoideis 2.5–3 mm. latis longisque pilulis sparsis donata alibi glabra; antheris basaliter lateraliterque cohaerentibus, tubum formantibus, 9–12 mm. longis, 2.5–3.5 mm. supra basim affixis, basibus 6–9 mm. infra fundum sinuum corollae positis, apicibus sterilibus 1–2 mm. longis saepe exsertis, connectivo tumido muriculato; filamentis 6–8(–9) mm. longis, ligulatis, basim versus plus minusve ampliatis, 10–13 mm. supra basim corollae orientibus, basi 5–7 mm. longe decurrentibus; nectario anguste glabro lobulato ad 0.4 mm. alto.

BALUCHISTAN: Quetta, 1888, *Duthie 8682* (TYPE, Dehra Dun); Hanna, 7000 ft., 1888, *Lace 3776* (DD); Moorga to Hindubagh, 5500 ft., May 5, 1895, — no. *18925* (DD); without loc., 1891–4, *C. F. Elliott* (DD); without loc., *Sticks 1137* (DD).

AFGHANISTAN: without loc., *Griffith 5947* (G).

A coarse, very bristly herb notable among its close relatives for its relatively broad green leaves.

7. **Onosma Griffithii** Vatke, Zeits. Gesammten Naturwiss. (Berlin) 45: 127 (1875). — Type from "Afghanistan," *Griffith 5947.*

Plant apparently perennial, cinereous, bristly with stiff slender hairs 2–3 or sometimes 5 mm. long, also minutely hispidulous with hairs 0.05–

0.1 mm. long; stems several, 1–3 dm. tall, simple or occasionally with short floriferous branchlets near the apex, 2–5 mm. thick towards the base; leaves firm, rarely with visible veins, upper surface with the bristles frequently antrorsely appressed; basal leaves linear-oblanceolate, 6–10 cm. long, 4–12 mm. broad, obtuse; middle cauline leaves linear, 3–5 cm. long, 3–7 mm. broad, acute or obtuse; cymes terminal, simple or sometimes forked, at anthesis 3–4 cm. broad; bracts lanceolate; calyx at anthesis 15–20 mm. long, lobes subulate-linear, 1–1.5 mm. broad, pedicel 1–3 mm. long; mature calyx 18–23 mm. long, lobes 2–3 mm. broad, pedicles 5–10 mm. long; corolla 27–30 mm. long, from a base 2.5–3 mm. thick gradually ampliate, becoming 7–8 mm. thick below the sinus, entirely glabrous or with a few hairs on the outside of the lobes; anthers 11–12 mm. long, united into a tube, affixed 3.5–4 mm. above base, base held 7–8 mm. below level of corolla-sinus; connective thickened, muriculate; filaments 8–9 mm. long, ligulate, arising 12–15 mm. above base of corolla, decurrent base 4–7 mm.; nectary narrow, lobulate, less than 0.5 mm. high, glabrous.

INDIA: Razani, Waziristan, 8000 ft., fl. white, Apr. 1924, *A. G. Lester-Garland* (K); Waziristan, *Harsukh 15805* (DD); Lekesur, Salt Range, Punjab, March 22, 1881, *Fleming* (Ed); Bundai, Chitral, *Harriss 16404* (DD).

AFGHANISTAN: without loc., *Griffith 5947* (DD, TYPE number).

What is here called *Onosma Griffithii* is an extremely unsatisfactory concept. It includes plants showing evident relations with *O. khyberianum* as well as with *O. barbigerum* and possibly is an aggregate. Furthermore, the name applied to it is one associated with much doubt.

The proper classification and the precise relations of the plants here referred to *O. Griffithii* can be established only after the study and analysis of a larger series of better specimens from western India than has been available to me. *Onosma Griffithii* Vatke was published in a journal not readily available to most botanists and was described as follows: "Onosma (Euonosma) Griffithii Vatke. totum setis longis albis patulis e tuberculo glabro ortis dense vestitum, caulibus e rhizomate pluribus adscendentibus diffusis simplicibus, foliis basalibus oblongo-lanceolatis basi petiolatim angustatis, caulinis sessilibus, superioribus ovato-lanceolatis, omnibus obtusiusculis, spicis brevibus plurifloris, calycis albo-setosissimi laciniis lanceolatis, corollae glabrae calyce parum longioris lobis brevibus obtusis reflexis, antheris filamento subtriplo longioribus ad medium fere exsertis. In Affghanistan coll. Griffith! n. 5947 ex distrib. kew. 1863-4 (n. 5946 ejusdem coll. ex. sp. nimis incompleto determinare nequeo.) Planta alt. fere 2 dm.; folia inferiora ad 7 cm. longa, ad 1 cm. lata subtus costa margineque praecipue setosa; corollae tubus c. 2 cm. longus."

The diagnosis is ambiguous and, I suspect, probably hastily and carelessly prepared. *Griffith 5946* is the type-collection of *O. limitaneum* var. *majus* Johnston. Unhappily there is some doubt as to the identity of the plant available to Vatke as *Griffith 5947*. This type, formerly at Berlin, was a casualty in the recent war. The number appears to be associated

with a mixture of closely related species. Stroh, Beih. Bot. Centralbl. 59[B]: 433 and 435 (1939), cites *O. Griffithii* in the synonymy of both *O. setosum dichroanthum* and *O. stenosiphon*. A duplicate at the Gray Herbarium (though imperfect) appears to represent *O. barbigerum*. Another at Dehra Dun I am accepting as representative of *O. Griffithii*, since it agrees better with the description of the species. Vatke's description, however, calls for a plant with a rhizome, a corolla 2 cm. long, and anthers exserted to the middle and about three times as long as the filaments. These are developments very different from those found in either of the duplicates of *Griffith 5947* available to me. Since I doubt the accuracy of Vatke's diagnosis I have ignored the discrepancies noted.

8. **Onosma Waltoni** Duthie, Kew Bull. 1912: 41 (1912). — Type material from Gyantze, Tibet, *Walton 60, 1560* and *1562*.

Plant "perennial, suffrutescent at base," stems becoming at least 3 dm. long and 2.5 mm. thick, hispid (hairs 1–2 mm. long, straight, spreading, bulbose-based, moderately numerous) and also retrorsely appressed hispidulous (hairs abundant, 0.1–0.3 mm. long); leaves "2–4 cm. long, 6–8 mm. broad," firm, veinless, upper surface hispid and hispidulous (the hairs loosely appressed and all bulbose based), lower surface sparingly bristly; basal leaves not seen; cauline leaves oblanceolate, 2–4 cm. long, 4–6 mm. broad, obtuse base broadened and semi-amplexicaul; cymes solitary, terminal on main stems and on slender peduncles 1–3 cm. long arising from many leaf-axils, at anthesis dense, 1–2 cm. broad; calyx at anthesis 6–7 mm. long, appressed white villose inside, outside pungently bristly, pedicel 1–3 mm. long, in fruit almost 9 mm. long with pedicels up to 8 mm. long; corolla 14 (fide Duthie 10–30) mm. long, from a base 1.5–2 mm. thick gradually expanded, becoming 6–7 mm. thick just below the sinus, texture unusually thin, densely but very minutely and inconspicuously puberulent, evidently hairy only on the nectary and outside near tip of lobes; corolla-lobes triangular, 2 mm. broad, 1.5 mm. long; anthers 7 mm. long, coherent basally and laterally to form a tube, affixed 2–2.5 mm. above base, base borne ca. 5.5 mm. below level of corolla-sinus; filaments very slender, 3–3.3 mm. long, arising 6.5–7 mm. above corolla-base, very minutely and inconspicuously puberulent, decurrent base about 3 mm. long, linear, puberulent, marked by a slight intrusion on outer surface of corolla; nectary villose, membranous, ca. 0.2 mm. high, apparently lobulate; style 15 mm. long, glabrous; nutlets 2.5–3 mm. long, lustrous, white, obscurely "tuberculate" or rugose.

TIBET: Gyangtse, 1904, *Walton s. n.* sub *O. Waddellii* (Ed).

My account of this species is based upon the unnumbered collection made by Walton cited above. Though labeled "*Onosma Waddellii* Duthie, n. sp.," it agrees reasonably well with the original description of *O. Waltoni* and was collected at the same locality and by the same collector as the numbered syntypes of that species. It differs from the original description in having corollas 14 mm., rather than 10–30 mm. long, and in having

the filaments arising at or near the middle of the corolla and not, as Duthie infers, distinctly below the middle. The species described is a well-marked one and is perhaps most closely related to *O. Waddellii*. From that species it differs in having a more elongate, more cylindrical corolla which not only has a thinner texture, but is also more abundantly puberulent on the outer surface. Its filaments are borne near the middle of the corolla, not below, and are decidedly puberulent. The decurrent base of the filaments is linear, more elongate, and decidedly puberulent, not lanceolate nor tumid. The stem-leaves are more broadly sessile. The puberulence on the corolla of *O. Waltoni* is very distinctive. It is composed of abundant, very minute, short thickish hairs, and at times appears somewhat farinose.

9. **Onosma Wardii** (W. W. Sm.), comb. nov.

Onosma Hookeri var. *Wardii* W. W. Smith, Notes R. Bot. Gard. Edinburgh **9:** 113 (1916).—Type from Ka-gwr-pw [Ka-kar-po] mountain, northwestern Yunnan, *Ward s. n.*

Plant perennial, arising from a dye-stained taproot, indument slenderly hispid (hairs 1.5–5 mm. long, ascending) and villulose (hairs pale, 0.2–0.3 mm. long); stems ascending or decumbent, several, 3–6 dm. long, usually simple, 3–5 mm. thick towards base, hispid and retrorsely villulose; leaves with upper surface green, with appressed bristles 1.5–3 mm. long, arising from discoid bases, lower surface pale, abundantly villulose and hence somewhat velvety, coarse hairs few; basal leaves persisting at anthesis, oblanceolate, 10–18 cm. long, 1–2 cm. broad, acute; middle cauline leaves lanceolate or oblong-lanceolate, acute, 5–9 cm. long, 6–12 mm. broad, base acute to rounded; cymes simple, terminal on the main stem and on short peduncles in the uppermost axils, at anthesis 3–5 cm. broad; calyx 12–17 mm. long, villose, pedicels 5–15 mm. long; corolla "purplish blue," 20 mm. long, antrorsely strigose outside, inside appressed villose along a line below each corolla-lobe, except for the villose nectary otherwise glabrous, from a base 2 mm. thick gradually expanding and becoming 8–11 mm. broad at the level of the sinus; anthers 10 mm. long, joined basally and laterally to form a tube, affixed 2–3 mm. above base, sterile apex ca. 2 mm. long, base carried 9 mm. below level of corolla-sinus; filaments 6.5 mm. long, arising 6.5 mm. above corolla-base, decurrent base 2–3 mm. long; nectary 0.2 mm. high, lobed, villose; nutlets not seen.

CHINA (Northwest Yunnan): Temple, Ka-gwr-pw, Mekong-Salween divide about lat. 28°30′, 13000 ft., July 26, 1913, *Ward 902* (Ed, TYPE; G, ISOTYPE); specimen grown in England from seed collected by Ward, sub no. 902, 1914, *Bees Ltd.* (Ed).

This plant from near the Tibetan border in northwestern Yunnan in gross habit very much resembles *O. Hookeri* var. *intermedium* of southeastern Tibet. By coincidence the two plants were given confusingly similar names when they were originally described. Our plant was called *O. Hookeri* var. *Wardii* W. W. Sm. (1916) and that from Tibet *O. Hookeri* subsp. *Wardii* Stapf (1931). These two plants, however, differ in many

respects and are obviously different species. In our plant, *O. Wardii*, the corolla is strigose outside and has a vertical line of hairs below each lobe on the inside of the throat. Its anthers are united into a tube and its filaments arise below the middle of the corolla. In the Tibetan plant (now called *O. Hookeri* var. *intermedium*) the larger corolla is villose-strigose outside and glabrous on the throat inside. Its anthers are united at the base only and its filaments arise midway up the corolla. The decurrent bases of its filaments are narrow, thickish, and very prolonged. Despite their superficial resemblances, the two plants are probably not closely related. *Onosma Wardii* probably has its closest affinities with the habitally dissimilar *O. confertum*.

10. **Onosma confertum** W. W. Smith, Notes. R. Bot. Garden Edinburgh 8: 106 (1913). — Type from mountains enclosing Lang Kong River, Yunnan, *Forrest 6436*.

Onosma Forrestii W. W. Smith, Notes R. Bot. Garden Edinburgh 8: 107 (1913) — based on garden plants grown from seeds collected in Yunnan by Forrest in 1910.

Plant arising from a coarse dye-stained taproot; stems usually single from the basal leaf-cluster, erect, 3–10 dm. tall, 3–9 mm. thick towards the base, sparingly hispid (hairs 1–3 mm. long, spreading or ascending, with a thickened base) and villulose-hispidulous (hairs 0.1–0.3 mm. long, appressed, mostly antrorse but tending to be retrorse below middle); leaves veinless, upper surface green, appressed or spreading hispid the hairs usually with discoid bases, lower surface sparingly hispid, usually pallid from an abundance of minute pale hairs; basal leaves usually dried at flowering time, oblanceolate, acute, 10–15 cm. long, 9–18 mm. broad; middle cauline leaves lanceolate, 4–12 cm. long, 5–15 mm. broad; cymes numerous, simple or forked, at anthesis 2–4 mm. broad, terminal on the stem and on slender peduncles 3–10 cm. long from the axils above the middle of the plant, hence in an elongate open paniculate arrangement; calyx 9–12 mm. long, pedicels slender, 6–12 mm. long; corolla pink, red, or purple, 13–18 mm. long, from a base 1.5–2 mm. thick gradually expanded and becoming 7–11 mm. thick at the level of the sinus, evidently strigose outside, inside with hairy nectary and frequently with a line of hairs below each corolla-lobe but otherwise glabrous; anthers 6.5–8.5 mm. long, coherent basally and laterally to form a tube, affixed 1–1.5 mm. above base, base borne generally 6–7 mm. below level of corolla-sinus; filaments 5–8 mm. long, arising 3–4 mm. above corolla-base, decurrent base 2–2.5 mm. long, generally broadened and thickened downward towards the abruptly rounded lower end; nectary represented by five villose lobules; style glabrous 16–18 mm. long; nutlets 2.5–3 mm. long, brownish, angular, more or less warted.

Known from middle northern Yunnan and northward into western Sikang.

YUNNAN: mountains enclosing Lang Kong River, lat. 26°10′, dry arid situations, plant 2–3.5 ft. tall, 8000–9000 ft., fl. soft rose, *Forrest 6436* (Ed,

TYPE of *O. confertum;* G, UC, ISOTYPES); mountains forming Lang Kong gorge, southern boundary of Lang Kong Valley, lat. 26°10′, 8000 ft., plant 1–2 ft. tall, exceedingly dry rocky slope, fl. bright blue, *Forrest 5991* (Ed); Ahsi, northwest Likiang Snow Range on Yangtze, open ledges, plant 3 ft., fl. dull rose-purple, *R. C. Ching 20786* (G); Yülun-schau near Likiang, *Handel-Mazzetti 7009* (G); inter Lanticho et Poloti, reg. Yungning-Yungpeh, ad l. m., fl. obscure purp., 2500 m., *Schneider 1682* (G, Ed); Mt. Wuaha, Tungning Terr., pine forest, 10000 ft., fl. purplish red, *Rock 24234* (NY, Ed); Chungtien, *T. T. Yü 12496* (G); western Yunnan, *Forrest 28822* (G).

SIKANG: above Litang river, 9000 ft., shaded limestone cliff, *Ward 4263* (G, Ed); Muli, Ku-lu, Hai-yeh-tze, 3100 ft., *T. T. Yü 14323* (G); Muli, Gu-tu, 2200–2300 ft., *T. T. Yü 14211* (G).

WITHOUT LOCALITY: garden plant, grown from seeds collected by Forrest, flowered by Bees Limited in July 1912, *herb. Edinburgh* (Ed, TYPE of *O. Forrestii*).

A well-marked species to be confused only with *O. album.* The latter differs, however, in flower-color, extruded stamens, hairy style, and unthickened decurrent base of the filaments. In gross habit the two species are remarkably similar. When young these species have the habit of a biennial. The taproot develops a leaf-rosette the first season and the following season a single erect stem bearing paniculately disposed cymes. With biennials such as *O. paniculatum* the root dies after the fruiting season. Our present plant, about the base of its fruiting stem, forms short stout offsets which produce new leaf-clusters and eventually additional flowering stems

The type of *O. Forrestii* is an abnormal plant grown in the British Isles from seed collected by Forrest during 1910, very likely along the Lang Kong River in northern Yunnan, where the type specimen of *O. confertum* originated also. The peculiarities of *O. Forrestii* probably resulted from growth in an unfavorable environment. In technical characters it agrees with *O. confertum* satisfactorily.

11. **Onosma sinicum** Diels, Bot. Jahrb. 29: 546 (1901). — Type from "Wen-chuan, Ta-chi-kou," Szechuan, *Rosthorn 3011.*

A suffruticose perennial; root woody; stem slender, 1–4.5 mm. thick; old stems loosely branched, sprawling or decumbent, 1–3 dm. long, producing numerous axillary leaf-fascicles or leafy floriferous branchlets, old parts leafless and decorticating; branchlets erect or ascending, slender, 5–15 cm. long, very leafy, hispid (hairs 1–2 mm. long, with a thickened base, spreading or ascending) and also hispidulous (hairs 0.1–0.4 mm. long, slender, erect or ascending); leaves all cauline, veinless, oblanceolate, 0.7–5 cm. long, 1.5–9 mm. broad, acute or obtusish, broadest at or above middle and gradually contracting to a very narrow or even subpetiolate base (or uppermost leaves lanceolate or even elliptic), upper surface usually appressed hispid (hairs ca. 1 mm. long, with discoid bases) and also minutely hispidulous, lower surface paler, abundantly hispidulous; cymes small, simple or rarely forked, at anthesis 1.5–2 cm. broad, in age uni-

laterally racemose and 5–10 cm. long, terminal on the leafy branchlets or borne on slender peduncles 1–2 cm. long arising from the uppermost leaf-axils; bracts small, lanceolate or ovate-lanceolate, 1–4 mm. long; calyx 7–9 mm. long, strigose to hispid-villose; lobes linear to lance-linear, 0.5–1 mm. broad; pedicel slender, at anthesis 1–3 mm. long, becoming 3–8 mm. long in fruit; corolla blue, 8.5–9.5 mm. long, from a base 2–2.5 mm. thick at first gradually then more abruptly expanded, becoming 4–6 mm. thick below level of sinus, outside antrorsely puberulent and sparsely strigulose; anthers 5.5–6.6 mm. long, united on base and sides to form a tube, conspicuously exserted, affixed 1–1.5 mm. above base, sterile tip very short about 0.5 mm. long, base carried 0–2 mm. below level of corolla-sinus; filaments 5–7 mm. long, slender, slightly thickened above the non-decurrent attachment, arising 2.5–3 mm. above corolla-base, conspicuously villose at the base; nectary consisting of 5–10 lobules 0.1–0.2 mm. long, densely villose; style 10–16 mm. long, glabrous; nutlets 2–2.5 mm. long, gray, dull, verrucose.

CHINA (Szechwan): Pehchuan Hsien, Sihchuan, on rocks, herb 5–8 inches tall, fl. blue, *W. P. Fang 5608* (G, Ed); Mo Hsien, Mowchow, roadside herb 1–2 ft. tall, fl. blue, *W. P. Fang 1503* (G, Ed); descending to Mao-kung Hsien, rocky place at roadside, 3000–3200 m., fl. blue, some red, *F. T. Wang 21298* (G).

This species is known only from northwestern Szechuan. The type was collected along the Min River about 100 km. northwest of Chengtu. The closest relative of the plant appears to be *O. Farrerii,* which ranges just north of it in southern Kansu. Both species have similar suffruticose habit and both have similar oblanceolate leaves contracted to a very narrow base. The flowers of the two species, however, are very different. In *O. Farrerii,* except for the sparingly hairy nectary, the corolla is glabrous inside. Its larger anthers have elongate sterile tips and its glabrous filaments have a broader base.

12. **Onosma burmanicum** Collett & Hemsley, Jour. Linn. Soc. London, Bot. 28: 93 (1891). — Type from Shan Hills, Burma, at 4000 ft., "once met with, growing gergariously on a grassy hill-side on road from Koni to Fort Stedman, by way of the Inleywa Lake," *Collett 941.*

Plant becoming at least 1 m. tall and possibly shrubby; stems elongate, unbranched, erect, 5 mm. thick towards the base, somewhat woody, apparently vegetative during several years, producing a very crowded mass of foliage (internodes ca. 1 mm. long) and lengthening only 0.5–1.5 dm. each season, during the final season lengthening at least 4–5 dm. (internodes as much as 20 mm. long) and terminating in the inflorescence; leaves on sterile stems 6–11 cm. long, from the sessile base 2–5 mm. broad very gradually narrowed towards the apex, linear-cuneate, extremely numerous and crowded, ascending or spreading, in age deflexed, dead ones persisting and clothing the older portions of the stem, margins usually strongly revolute and more or less obscuring the lower surface, upper surface green scabrous hispid (hairs slender, 1 mm. long, with a pallid bulbose base),

lower surface usually pallid from an abundance of slender appressed silky hairs; leaves on elongate floriferous shoot lanceolate to cuneate, 3–4 cm. long, 3–6 mm. broad, sessile, narrowly revolute, upper surface with appressed hairs lacking bulbose bases, lower surface smooth, white, silky strigose; inflorescence loosely paniculate, composed of numerous cymes borne on bracteate peduncles (1–5 cm. long) springing from the axils along the upper 1–2 dm. of the main stem, 10–15 cm. broad, 10–30 cm. long; cymes small, at anthesis 1–2 cm. broad, at maturity straightening and lengthening, becoming about 5 cm. long; calyx 8–10 mm. long, lobes 0.5–1 mm. broad, linear; pedicels 3–5 mm. long at anthesis, later as much as 10 mm. long; corolla 10.5–13 mm. long, with a short subcylindric tube 2–2.5 mm. broad and 2.5–3 mm. long, then with a gradually ampliate throat becoming 5–7 mm. in diameter at the level of the sinus, with tight inflexed vertical pleats below each sinus, outside abundantly antrorse strigose above the middle, inside conspicuous villulose in a band 2–4 mm. above the base, except for the villulose nectary otherwise glabrous; anthers 7–10 mm. long, united into a tube, conspicuously exserted, affixed 1.5–2.5 mm. above base, sterile tip 2–2.5 mm. long, base carried 1.5–2.5 mm. below level of corolla-sinus; filaments 5.5–7.5 mm. long, very slender, hairy towards base, not decurrent, arising 2.5 mm. above corolla-base; nectary very narrow, lobed, villose, ca. 0.1–0.2 mm. high; style 11–17 mm. long, glabrous; nutlets 3–3.5 mm. long, dull, brownish, verrucose.

BURMA: Fort Stedman, Upper Burma, lat. 20°30′, Dec. 1892, *Abul Hak* (DD); Shan Hills, Koni dist., 4000 ft., Nov. 12, 1888, *H. Collett 941* (K, TYPE); Gawle Reserve, Thaungyun Div. (ca. lat. 16°30′), hilly ground, fl. brown, Sept. 20, 1924, *Burman Collector* (DD, G).

A very distinct species, remarkable in a number of respects. It is the most southerly ranging species in the entire genus. Its habit of growth is unlike that of other congeners. Unhappily collectors have not provided information concerning the appearance and behavior of the living plant. From what can be deduced from the specimens available, it is probably shrubby, and very likely becomes more than a meter tall. Its growth-habit may suggest that of some of the smaller shrubby species of *Echium* known from the Canary Islands. Certainly no other member of *Onosma* develops simple erect shrubby stems which annually produce a dense new terminal leaf-cluster after a yearly growth of only 5–10 cm. until finally, after slow growth and vegetating for as much as five years, they terminate in a final season by lengthening as much as 5 dm. and by producing flowers. The vegetative branches are about 5 mm. thick, have very short internodes, and bear their very slender elongate functional leaves in a brush-like terminal cluster above the skirt-like mass of dead persisting reflexed leaves from previous seasons.

The material I have examined comes from two areas separated by some 300 miles; one from the Shan Hills near Lake Inle, lat. 20° 30′, and the other from near the Siamese border, east of Moulmein, at about lat. 16°30′. Comparable parts from the two are very similar; indeed, the chief

difference appears to be in their pubescence. In the northern material the hairs along the stem and on upper leaf-face are tightly appressed, whereas in the southern material they are loosely appressed or ascending. The collection from the south is of great interest, since it includes sterile vegetative stems (described above) as well as the flowering shoot. The type from middle eastern Burma consists of the flowering shoot only.

13. **Onosma hypoleucum,** sp. nov.

Planta perennis fruticulosa pallida; caulibus foliosis, gracilibus, 3–5 dm. altis, basim versus 1–2.5 mm. crassis, pluribus, e basi lignosa orientibus, saepe erectis simplicibusque, sparse hispidis (pilis 1–1.5 mm. longis patentibus vel adpressis e basi pallida bulbosa orientibus) et abundanter albostrigulosis (pilulis 0.1–0.4 mm. longis antrorsis); foliis numerosissimis oblanceolatis vel lineari-lanceolatis 1.5–3 cm. longis 1.5–5 mm. latis enervatis firmis margine revolutis, in facie superiore cinereis basibus pallidis pilorum majorum notatis, in facie inferiore albis abundantissime sericeostrigulosis; cymis sub anthesi ca. 2 mm. latis, maturitate elongatis ad 10 cm. longis, terminalibus et e axillis supremis 1–3 cm. longe pedunculatis; calyce 10–13 mm. longo, lobis linearibus 0.5–1 mm. latis, pedicello gracili 1–10 mm. longo; corolla coerulea 10–11 mm. longa a basi 2 mm. crassa sursum ampliata sinus versus 4–5 mm. crassa extus minute abundanteque antrorso-strigosa, intus parte 1.5–2.5 mm. supra basim villosa, lobis 1–2.5 mm. latis 1–1.5 mm. longis margine revolutis; antheris 9–10 mm. longis in tubum cohaerentibus exsertis 1.5–2 mm. supra basim affixis, apicibus sterilibus 1–1.5 mm. longis, basibus ca. 2 mm. sub sinus corollae positis; filamentis 6–7 mm. longis 1.5–2 mm. supra basim corollae orientibus, a basi 0.3–0.5 mm. lata haud decurrenti sursum gradatim ampliatis ca. 0.5–1 mm. supra basim latissimis (0.5–0.7 mm. latis) deinde apicem versus gradatim attenuatis, parte 1–2 mm. longa infima villosis; nectario angusto lobato 0.1–0.3 mm. alto villoso; stylo 15 mm. longo glabro; nuculis 2.5–3 mm. longis nitidis pallidis obscure rugulosis.

Known only from the northwestern Himalaya, long. 73° to 76°30′.

INDIA: Changla Gali, Murree Hills, Punjab, 6500 ft., cliffs, fl. blue, Aug. 27, 1918, *R. R. Stewart 3956* (NY); Nagan, Muzaffarabad, range forest, Kishanganga Valley, Kashmir, 10000 ft., Sept. 1, 1907, — no. *1807* (DD); Chamba, 1896, *G. A. Gammie* (DD); Dharmsala, Kangra dist., Punjab, *Edgeworth* (DD); without loc., *J. L. Stewart 2239* (Ed); without loc., *Falconer* (TYPE, Gray Herb.).

It is surprising that this well-marked species has remained so long confused with *O. Thomsoni,* a habitally very similar plant also found in the front ranges of the northwestern Himalaya. The present plant does have more slender stems and smaller leaves beautifully silky strigose and white beneath, but the most marked differences from *O. Thomsoni* are those inside the corolla. The blue corollas of *O. hypoleucum* have a broader throat which outside is finely and evenly antrorse-strigose, not retrorsely strigose as in the white corollas of *O. Thomsoni.* This difference in pubescence is particularly well marked on the flower-buds. Inside the corolla is

evidently villose in a band 1.5–2.5 mm. above the base. Its filaments are hairy and perceptibly constricted just above their narrow attachment. In *O. Thomsoni* the filaments are glabrous and have a broad arcuate attachment and are not basally constricted. The two species are not even closely related.

14. **Onosma exsertum** Hemsley, in Hook. Icones Pl. **27**: t. 2639 (1900). — Type from grassy hills near Mengtze, Yunnan, *Henry 9334*.

Plant robust, 3–12 dm. tall, biennial; stem single, branched only in inflorescence, 5–10 mm. thick towards base, hispid (hairs 1–2 mm. long, few to many, ascending or closely and antrorsely appressed, base thickened) and also very minutely and inconspicuously hispidulous (hairs 0.1 mm. long); leaves somewhat coriaceous, veinless, upper surface green, strigose (hairs rigid, ca. 1 mm. long, with evident discoid bases), minute hairs scarce or none, lower surface with abundant minute hairs, ca. 0.1 mm. long and less abundantly and coarsely strigose; basal leaves developed the first year, oblanceolate, up to 30 cm. long and 7 cm. broad, obtusish; middle cauline leaves lanceolate or lance-oblong, acute 5–10 cm. long, 1.5–3 cm. broad; cymes numerous, relatively loose, 1–3 cm. broad at anthesis, terminal on the main stem and also on slender naked peduncles (3–10 cm. long) arising from the axils along the upper half of the main stem, hence displayed in a loosely paniculate arrangement; calyx 7–10 mm. long; lobes lanceolate, thickish, densely clad with short stout closely appressed thick-based hairs; pedicels 3–14 mm. long; corolla red then purple, 9–11.5 mm. long, with a subcylindric base 2 mm. thick and 3.5–4.5 mm. long and then expanding into a somewhat campanulate throat becoming 4.5–5 mm. thick, outside hispidulous or strigulose, usually retrorsely so, inside scantily strigulose along a vertical line below the lobes but otherwise glabrous; anthers 5.5–6.5 mm. long, united into a tube, usually completely exserted, affixed 1.5–2.5 mm. above base, sterile tips ad 1 mm. long, base carried at or above the level of the corolla-sinus; filaments 7.5–9.5 mm. long, subulate, glabrous, affixed 2.5–3.5 mm. above base of corolla, decurrent base 0.5–1 mm. long; nectary a very narrow glabrous collar 0.1–0.2 mm. high; style glabrous, 15–19 mm. long; nutlets ca. 3 mm. long, lustrous, pale, rugulose.

Southwestern China, in Yunnan and southern Sikang.

YUNNAN: Mengtze, *Henry 9334* (NY, US) and *9334B* (US); western flank of Tali Range, lat. 25°40′, 9000 ft., open stony pasture, plant 3 ft., fl. deep maroon, *Forrest 11586* (Ed); betw. Tsuyung and Gwangdung, ca. lat. 25°, *Handel-Mazzetti 4826* (G); Chungtien plateau, lat. 27°30′, open stony pasture, 9000 ft., *Forrest 12752* (Ed).

SIKANG: He-chang Hsien, mountain slope, open place, 1850 m., herb 2–4 ft. tall, fl. purplish blue, July 8, 1932, *T. T. Yü 1164* (G).

A very well marked species lacking any obviously close relative. It is notable for the coarse, short, closely appressed or even incurving hairs abundant on the inflorescence and especially on the pedicels and calyx, and frequently on the upper leaf-face also. Among the species with a

single very coarse tall stem it is readily recognized by the combination of completely exserted anthers and small corolla with rather well differentiated tube and throat.

15. **Onosma fistulosum,** sp. nov.

Planta robusta elata biennis; caulibus solitariis (fortasse supra medium ramulis floriferis gestis) fistulosis basim versus 8–14 mm. crassis hispidis (pilis 2–4 mm. longis patentibus retrorseve basi bulbosis); foliis in facie superiore viridibus scabris hispidulis (pilis abundantibus rigidiusculis patentibus 1–2 mm. longis basi pallida bulbosa orientibus), in facie inferiore nervatis hispidulis vel abundanter pallideque strigulosis et sparse hispidulis; foliis infimis ad 4 dm. longis et 4–6 cm. latis medium versus vel supra medium latioribus deinde apicem acuminatum versus gradatim contractis, basim versus in petiolum alatum ad 5–7 mm. latum et 10 cm. longum attenuatis; foliis caulinis medium versus latioribus utroque attenuatis, majoribus ad 2–2.5 dm. longis et 4–5 cm. latis; cymis fortasse numerosissimis in paniculatum amplam collectis sub anthesi 2–3 mm. latis; calyce 9–12 mm. longo basim versus hispido, lobis 1–1.7 mm. latis lanceo-linearibus; pedicello gracili 6–12 mm. longo; corolla 11–15 mm. longa a basi 2 mm. crassa primo leviter deinde validiore ampliata sinus versus 7–10 mm. crassa, extus supra medium sparse antrorseque strigulosa, intus (nectario excepto) glabra; lobis triangularibus 3–4 mm. latis 1.5–2 mm. longis margine revolutis; antheris 7–8 mm. longis in tubum cohaerentibus exsertis ad 2 mm. supra basim affixis, apicibus sterilibus 1.5–2 mm. longis, basibus 1–4 mm. infra sinus corollae positis; filamentis 7–9 mm. longis subulatis glabris 3–4 mm. supra basim corollae orientibus basi haud vel vix decurrentibus; nectario angusto 0.1–0.2 mm. alto lobato villoso; stylo 14–18 mm. longo glabro; nuculis ignotis.

CHINA: "Szechuan" [but probably within present-day Sikang], "en route," July 25, 1905, 5000 ft., fl. reddish, suffused purple, *E. H. Wilson 4165* (G); Wachin, Muli, Sikang, oak forest, 3000 ft., Sept. 1937, *T. T. Yü 14385* (TYPE, Gray Herb.).

A very well marked plant and probably the largest and most robust in the genus. It has a coarse single stem probably reaching 1–2 m. in height, and no doubt displays its cymes in a very large and ample panicle. The material available shows the stout biennial root and the base of the stem as well as some large basal leaves. Also available are sections of the coarse stem showing the leaves and one of the axillary floriferous branches produced by it. The coarse main stem, though becoming more than a centimeter thick, is hollow and pipe-like. The shell of conductive and support tissue surrounding the large central cavity is 1–3 mm. thick. In old stems it becomes hard and woody. The two collections studied have inadequate data. That from Yü was received with a collection-number but no field data. The locality I have given for it is that associated with other collections in the same gamut of numbers. Wilson's collection has no other data than that it was collected in Szechuan, "en route," on July 25

[? or 23], 1903. During the period of time indicated he was traveling in eastern Sikang. His collection is very similar in appearance to that of Yü.

16. **Onosma multiramosum** Handel-Mazzetti, Anzeiger Akad. Wiss. Wien 61: 166 (1924) and Symb. Sinicae 7²: 817 (1936). — Type from Yangtze about lat. 27° 45′, *Handel-Mazzetti 7596*.

Plant apparently perennial; stems erect or decumbent, 2–6 dm. long, becoming as much as 6 mm. thick towards the apparently persisting base, usually with numerous branchlets, hispid (hairs 1–4 mm. long, spreading, frequently pungent, base bulbose) and hispidulous (hairs abundant, 0.1–0.4 mm. long, retrorsely appressed) leaves usually veinless, numerous, all cauline, somewhat cinereous, hispid (hairs spreading, 1–2 mm. long, those on upper surface with bulbose base) and also abundantly hispidulous (hairs 0.1–0.2 mm. long, erect); lower leaves oblanceolate, 8–18 cm. long; middle leaves lanceolate to ovate-oblong, 3–6 cm. long, 5–15 mm. broad; cymes small, numerous, not forked, at anthesis 1–2 cm. broad, later elongating and becoming 5–12 cm. long, terminal on stem and branches and on peduncles 1–4 cm. long arising from the uppermost leaf-axils; calyx 6–9 mm. long, lobes slender, 0.5–1 mm. broad, pedicels 2–4 mm. long at anthesis later becoming 5–15 mm. long; corolla in the bud asymmetric, its tip strongly curving; corolla at anthesis white or violet, obscurely bilabiate, 8.5–10 mm. long, from a short subcylindric tube 1.5–2 mm. thick and 2–3 mm. long expanding into a throat becoming 3.5–5 mm. thick just below the sinus, outer surface antrorsely strigulose, inner surface with a vertical line of hairs below each lobe, throat infolded below each sinus and hence with 5 broad rounded ribs; lobes triangular, 2 mm. broad and 1.5 mm. long; anthers 7–9 mm. long, firmly united into a tube, with a prolonged curved tip, attached 1.5 mm. above base, sterile tip 2.5–3 mm. long, bases held 1–1.5 mm. below level of corolla-sinus; filaments subulate, glabrous, 5–6 mm. long, affixed 2.5–3.5 mm. above corolla-base, decurrent base as much as 1.5 mm. long; nectary narrow, lobed, 0.1–0.2 mm. high, villose; style 15–18 mm. long, glabrous; nutlets 3 mm. long, dull, tuberculate, pitted.

YUNNAN: mouth of Dou-tschu, valley of Yangtze [southwest of Chungtien], lat. 27°46′, 1650 m., fl. sordide violacei, *Handel-Mazzetti 7595* (Ed); Fengkou Valley, lat. 27°40′ [Yangtze bend], dry rocky place, 9000 ft., plant 1–2 ft., fl. white, *Forrest 12807* (Ed).

SIKANG: Mekong Gorge below Ya-ka-la, about lat. 29°, near Tibet-Yunnan borders, dry slate rocks in gorge, 9000 ft., fl. cream, anthers "state blue," 1922, *Ward 5362* in pt. (Ed).

16A. **Onosma multiramosum** var. **mekongense**, var. nov.

A varietate genuina differt faucibus corollae glabris; nectario sparse inconspicue villuloso.

YUNNAN: Mekong Valley [probably lat. 27°–29°], arid region, 8000 ft., 1913, *Ward 492* (TYPE, Edinburgh).

A most unusual feature of this plant is its clearly zygomorphic corollas. From the herbarium material available it has been impossible to determine

the orientation of the parts with complete certainty. It appears, however, that the adaxial side of the corolla is most prolonged. In the bud the distal third of the tightly folded corolla is decidedly bent or curved away from the axis of the cyme. On pendulous portions of the cyme this causes the bud-tips to be directed upwards. Later, however, when the cyme straightens, the curve or bend in the bud is downward. In open flowers borne on an erect axis it is the upper side of the corolla that is slightly but still very definitely more elongate than the lower. The zygomorphy of the corolla, however, is most obviously displayed in the anthers. These are well exserted and have their prolonged united sterile tips very noticeably decurved.

17. **Onosma adenopus,** sp. nov.

Planta perennis cinerea; caulibus solitariis vel pluribus e caudice laxo fruticoso orientibus 1–4 dm. longis, basim versus 2–3 mm. crassis, erectis vel adscendentibus, simplicibus vel apicem versus pedunculos axillares 1–3 cm. longos gracilis proferentibus, hispidis vel hispido-villosis (pilis 1–3 mm. longis, patentibus, basi inconspicue incrassatis) et strigulosis (pilulis 0.1–0.3 mm. longis retrorsis); foliis numerosis firmis enervatis, supra hispidis vel hispido-villosis (pilis adscendentibus 1–2 mm. longis basi discoidea orientibus) et villulosis (pilulis 0.1–0.3), subtus hispidis et villulosis; foliis basalibus oblanceolatis 1–4 cm. longis 2–6 mm. latis rosulatis; foliis caulinis medionalibus 1.5–4 cm. longis 2–12 mm. latis lanceolatis vel oblongis basi rotundis; cymis sub anthesi 1–2 cm. latis, maturitate elongatis 3–5 cm. longis; calyce 5–7 mm. longo, lobis gracilibus 0.5–1 mm. latis, pedicello 2–8 mm. longo; corolla violacea vel purpurea 8.5–9.5 mm. longa a basi 1.5 mm. crassa primo leviter deinde (1.5–2 mm. supra basim) validioriter ampliata, sub sinus 3.5–5 mm. crassa, supra medium infra sinus verticaliter plicata, extus praesertim in lobis antrorse minuteque strigulosis, intus supra medium secus nervos sparse strigosa; lobis 2–2.5 mm. longis 1.5 mm. latis erectis; antheris 6.5–7.5 mm. longis basaliter lateraliterque cohaerentibus exsertis tubum formantibus, 1–1.5 mm. supra basim affixis, apicibus sterilibus 2–3 mm. longis rectis, basibus ca. 2 mm. infra sinus corollae positis; filamentis 5–5.5 mm. longis subulatis e areola glandulifera minute papillata 1.5–2.5 mm. supra basim corollae orientibus, basim versus minute papillatis, basi haud decurrentibus; nectario ca. 0.1 mm. alto glaberrimo haud vel vix lobulato; stylo 9–17 mm. longo glabro; nuculis 2–3 mm. longis pallidis minute abundanterque papillatis et sparse tuberculatis.

CHINA (Sikang): Kon-ka-ling, Aug. 1937, *T. T. Yü 12909* (TYPE, Gray Herb.); Mekong Gorge, near Ya-ka-la, ca. lat. 29°, near Tibet-Yunnan border, young flowers pink, later turning bright violet, 1000 ft., *Ward 5363* (Ed); Dzer-nar, Tsa-wa-rung, 3200 m., oak bushes on dry sandy south exposure, fl. purple, 1935, *C. W. Wang 66520* (G); Shiangcheng, Sangbiling, 1937, *T. T. Yü 13370* (G).

A very well marked species probably most closely related to *O. multiramosum.* It is distinguished from all other congeners, at least in our area,

by having the base of the filament, as well as a small area on the corolla immediately surrounding it, glanduliferous and studded with papillae. The papillate areas on the corolla from which each filament arises are elliptic in outline and about 2 mm. broad. On the outside of the corolla their position is marked by a slight depression of similar size and shape. From *O. multiramosum* our species is also distinguished by having the less prolonged tip of the staminal tube straight rather than curved, as well as by having a completely glabrous rather than a villose nectary. Additional characters distinguishing it are found in its subsimple stems and in the more slender bristles on stems and leaves.

18. **Onosma album** W. W. Smith & J. F. Jeff. Notes R. Bot. Gard. Edinburgh 9: 112 (1916). — Type from Yung-pi Mts., Yunnan, *Forrest 11188*.

Plant 6 dm. tall, probably perennial; stem single, erect, 4–6 mm. thick towards base, bearing numerous pedunculate cymes from the axils above the middle, bristly (hairs 1–3 mm. long, spreading, with thickened base) and strigulose (hairs abundant, 0.1–0.3 mm. long, mostly retrorse); leaves veinless, above green, hispid, lower surface pale, densely strigulose and sparsely hispid; basal leaves mostly dried up at time of flowering, oblanceolate, 5–8 cm. long, 4–5 mm. broad, acute; middle stem-leaves lanceolate, 4–5 cm. long, 5–8 mm. broad, apex acute, base acute to rounded; cymes numerous, 1–4 cm. broad at anthesis, mostly simple, terminal on stem and on slender peducles 3–8 cm. long from upper axils, hence displayed in a loose elongate paniculate arrangement; calyx 10–13 mm. long, lobes lance-linear, pedicels slender, 5–20 mm. long; corolla pure white, 12.5–14 mm. long, from a base 2 mm. thick expanding and becoming 6–7 mm. broad just below the sinus, outside abundantly antrorse-strigulose, inside with hairs below the lobes and on nectary and decurrent base of filament; anthers 9.5–10 mm. long, coherent to form a tube, well exserted, affixed 2 mm. above base, sterile tips 2–3 mm. long, bases carried about 3 mm. below level of corolla-sinus; filaments 6–7 mm. long, arising 2.5–4 mm. above corolla-base, decurrent base 2–3 mm. long, bearing a few hairs towards its lower end; nectary very narrow, interrupted, villose, ca. 0.1 mm. high; style 14–20 mm. long, bearing some appressed hairs below the middle; nutlets not seen.

YUNNAN: on the Yung-pi Mts., lat. 26°45′, plant 2 ft., fl. pure white, open dry stony pasture, 10000 ft., Sept. 1913, *Forrest 11188* (Ed, TYPE).

A plant much resembling *O. confertum* in all save flowers. It differs in having a white corolla hairy in the throat, lobes less strongly recurved, anthers protruding, style hairy, and the decurrent base of the filaments unthickened.

(To be concluded)

STUDIES OF PACIFIC ISLAND PLANTS, IX
NOTES ON THE RUTACEAE OF FIJI, SAMOA, AND TONGA

A. C. SMITH

IDENTIFICATION OF THE SPECIMENS of Rutaceae recently obtained in Fiji by the writer[1] proved so difficult that a regional revision of the genera with dehiscent fruits seemed desirable. The species from Samoa, Tonga, and Niue are considered as well as those from Fiji. For the purposes of this study, the collections of the group in various herbaria have been examined, the place of deposit of specimens being indicated in this paper as follows: Arnold Arboretum (A); Bernice P. Bishop Museum (Bish); British Museum (BM); DePauw University (DP); Gray Herbarium (GH); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); University of California (UC); and U. S. National Herbarium (US). I am much indebted to the authorities of these institutions for the privilege of examining specimens under their care.

The subfamily Aurantioideae is not considered in this treatment, since the indigenous species of this subfamily in our region are only two. *Micromelum minutum* (Forst. f.) Seem. is abundant throughout; it is a fairly variable species in indument, and Seemann takes it to include *M. glabrescens* Benth., described from Tonga. *Wenzelia kambarae* Swingle (in Jour. Arnold Arb. **21**: 12. 1940) is apparently limited to the Lau Group in Fiji. Otherwise, the subfamily is represented in our region only by the several species or varieties of *Citrus* which have become more or less naturalized; for a consideration of the Aurantioideae the reader is referred to W. T. Swingle's treatment in Webber, H. J., and L. D. Batchelor, The Citrus Industry **1**: 129–474. 1944.

The difficulties inherent in generic delimitation in the Rutaceae are well known, but most students are satisfied to follow Engler's treatment of the family (in Nat. Pfl. ed. 2. **19a**: 187–359. 1931). It may, indeed, be a very long time before that critical treatment is supplanted by anything in the nature of an improvement. Some problems relating to the *Evodia-Melicope-Acronychia* group of genera are briefly considered for Papuasia by Merrill and Perry (in Jour. Arnold Arb. **22**: 32–59. 1941). Specimens from Fiji and the adjacent archipelagos belonging to these three genera can usually be placed without difficulty if good material is available, but whether or not the currently accepted generic limits are natural can be decided only after exhaustive study by a monographer.

[1] Under the auspices of the Arnold Arboretum of Harvard University and the John Simon Guggenheim Memorial Foundation, with the aid of grants from the Penrose Fund of the American Philosophical Society and the Bache Fund of the National Academy of Sciences.

In the region under consideration there are now recognizable 23 species of dehiscent-fruited Rutaceae; of these I describe eight species and two varieties as new, while two new combinations are made. A greatly simplified key to the four genera concerned follows:

Leaves alternate, pinnate, with 2–8 pairs of lateral leaflets (in our species); stamens 4.....1. *Fagara.*
Leaves (in our species) prevailingly opposite, 1- or 3-foliolate.
Stamens 4; ovary deeply 4-lobed, the carpels essentially free in fruit.....2. *Evodia.*
Stamens 8 (in our species).
Ovary shallowly lobed, the lobes firmly connate even in fruit.....3. *Acronychia.*
Ovary with free carpels, these united in flower by the styles, divergent in fruit.....4. *Melicope.*

1. FAGARA L.

The species of this alliance in our region belong to *Fagara* rather than *Xanthoxylum,* following the interpretation of Engler (in Nat. Pfl. ed. 2. **19a:** 214–224. 1931). The confused generic nomenclature of these groups has been remarked by Reeder and Cheo (in Jour. Arnold Arb. **32:** 67. 1951), whose use of the names follows most current procedure. The species discussed below fall into Engler's section *Blackburnia.*

Individual plants of *Fagara* appear to be very rare in Fiji and Tonga and lacking in Samoa. Until 1936 the genus had not been recorded from Fiji, but at that time I noted the occurrence of two species (in Bishop Mus. Bull. **141:** 76–77, as *Zanthoxylum*). It now appears that four species of the group occur in Fiji, one of them extending into Tonga.

KEY TO THE SPECIES

Leaflets 2–5 pairs, the blades entire or essentially so, obviously inequilateral at base; flowers and fruits distinctly pedicellate.
Leaves usually 10–27 cm. long, the petiole (2–)3–5 cm. long; leaflet-blades chartaceous, more or less translucent when dried, the venation obvious on both surfaces, the margin nearly plane.....1. *F. pinnata.*
Leaves 8–13 cm. long, the petiole 1.5–3 cm. long; leaflet-blades coriaceous, opaque, with less obvious venation, strongly revolute at margin.....2. *F. gillespieana.*
Leaflets 6–8 pairs, the blades crenulate at margin, the indentations marked by glands, the base only slightly inequilateral; flowers sessile in ultimate clusters of 2 or 3.
Leaves 25–30 cm. long, the petiole (2–3 cm. long) and rachis obviously canaliculate; leaflet-blades 5–7 × 2–3 cm.....3. *F. vitiensis.*
Leaves 40–50 cm. long, the petiole (10–12 cm. long) and rachis subterete; leaflet-blades 11–15 × 4–5 cm.....4. *F. myriantha.*

1. **Fagara pinnata** (J. R. & G. Forst.) Engl. in Nat. Pfl. III. 4: 119. 1896, ed. 2. **19a:** 224. 1931.

Blackburnia pinnata J. R. & G. Forst. Char. Gen. *pl. 6.* 1776; Forst. f. Fl Ins. Austr. Prodr. 10. 1786.

Ptelea pinnata L. f. Suppl. 126. 1781.
Zanthoxylum blackburnia Benth. Fl. Austral. **1**: 363. 1863; Burkill in Jour. Linn. Soc. Bot. **35**: 30. 1901.
Zanthoxylum pinnatum Druce in Rep. Bot. Exch. Club Brit. Isles **1916**: 653. 1917; A. C. Sm. in Bishop Mus. Bull. **141**: 76. 1936.

DISTRIBUTION: Norfolk Island (type locality) to Fiji and Tonga; probably also in Australia, but the New Caledonian plants so referred may not belong here.

FIJI: FULANGA: In forest on limestone formation, alt. 0–80 m., *Smith 1150* (Bish, GH, K, NY, UC, US) (*warui;* tree 12 m. high; petals white; anthers yellow).

TONGA: *Harvey* (K). VAVAU: *Crosby* (K); Talau hill, alt. 120 m., *MacDaniels 1093* (Bish) (tree 12 m. high, the trunk 25 cm. in diameter).

It may be suspected that this entity has been too broadly interpreted. The Forsters' type (BM) from Norfolk Island was not re-examined in connection with the present study, but in 1936 I was apparently satisfied that the material from Tonga and Fiji agreed with the type. The range and variation of the Forsters' species should be studied by a monographer of the group.

2. **Fagara gillespieana** sp. nov.

Arbor ad 20 m. alta sub fructu ubique glabra, ramulis validis teretibus cinereis, foliis inflorescentiisque apices ramulorum versus congestis; foliis 8–13 cm. longis, petiolo 1.5–3 cm. longo subtereti vel semitereti basi incrassato, rhachi gracili leviter canaliculata; foliolis 2–4(raro 5-)-jugis oppositis, petiolulis gracilibus canaliculatis 4–8 mm. longis, laminis coriaceis opacis in sicco fusco-viridibus ovato-oblongis, plerumque 4–5.5 cm. longis et 2–3 cm. latis, basi inaequilateraliter obtusis, apice obtuse et breviter cuspidatis, margine integris anguste sed valde revolutis, supra subnitidis, costa supra impressa subtus prominente, nervis secundariis utrinsecus 6–8 supra paullo subtus manifeste elevatis, rete venularum utrinque subprominulo vel supra immerso; inflorescentiis sub anthesi non visis, sub fructu inter folia patentibus 5–9 cm. longis pauciramosis, pedunculo brevi et ramulis gracilibus subteretibus in sicco rugulosis, bracteis caducis, pedicellis subteretibus 2.5–6 mm. longis, calyce circiter 2 mm. diametro, lobis 4 persistentibus minutis deltoideis obtusis; fructibus ellipsoideis maturitate ad 14 mm. longis et 11 mm. latis, utroque rotundatis, pericarpio coriaceo valde ruguloso, semine ad 11 × 9 mm. nitido ut videtur nigro.

FIJI: VITI LEVU: Mba: Summit ridge of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, alt. about 1100 m., *Gillespie 3943* (Bish, GH, UC); Nandronga & Navosa: Northern portion of Rairaimatuku Plateau, between Nandrau and Nanga, alt. 725–825 m., Aug. 7, 1947, *Smith 5578* (A TYPE, US) (*totowiwi;* tree 20 m. high, in dense forest).

Both cited specimens bear essentially mature fruits, but they seem indubitably closely allied to the preceding species, *F. pinnata.* The smaller, shorter petiolate leaves and the coriaceous leaflet-blades, which

are opaque, with comparatively obscure nerves and strongly revolute margins, seem adequately to differentiate *F. gillespieana* from its lowland relative.

3. **Fagara vitiensis** (A. C. Sm.) comb. nov.

Zanthoxylum vitiense A. C. Sm. in Bishop Mus. Bull. **141**: *77. fig. 38.* 1936.

DISTRIBUTION: Known only from the type collection.

FIJI: VANUA LEVU: Thakaundrove: Eastern buttress of Mt. Ndikeva, alt. 800 m., *Smith 1884* (Bish TYPE, K, NY, US) (slender tree 3 m. high, in crest thickets; petals and filaments white; anthers yellow).

This well-marked species is readily distinguished from *F. pinnata* by its more numerous leaflets with crenulate margins and by its sessile flowers; the new species described below is a closer ally. *Fagara vitiensis* is monoecious, but in the original description I failed to note the pistillate inflorescences, which are here described:

Pistillate inflorescences subterminal, similar to ♂ but perhaps with fewer flowers; flowers slightly more slender than the ♂ but with a similar perianth; staminodes 4, reduced to very minute brownish scales at base of gynaecium; gynaecium at anthesis about 2.5 mm. long, the ovary on a short conical gynophore, thick-walled, unilocular, the ovules 2, collateral, dependent, the style terete, very short, the stigma subcapitate, about 0.6 mm. in diameter.

4. **Fagara myriantha** sp. nov.

Arbor ad 15 m. alta, ramulis validis teretibus fusçis rugulosis primo obscure puberulis mox glabratis; foliis apices ramulorum versus aggregatis, 45–50 cm. longis, ad 30 cm. latis, ubique glabris, petiolo 10–12 cm. longo et rhachi pro magnitudine folii gracilibus subteretibus vel supra inconspicue complanatis; foliolis 6–8-jugis oppositis, petiolulis leviter canaliculatis gracilibus 7–10 mm. longis, laminis chartaceis opacis in sicco fusco-viridibus lanceolato-oblongis, imis 7–9 cm. longis et 3–4.5 cm. latis, superioribus 11–15 cm. longis et 4–5 cm. latis, basi late obtusis et leviter inaequalibus, superne in acuminem obtusum ad 1 cm. longum gradatim angustatis, margine conspicue crenatis (crenaturis 1 vel 2 per centimetrum, sinibus manifeste glanduloso-punctatis), costa supra subplana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 10–14 supra subplanis subtus acute elevatis, rete venularum supra obscuro subtus haud prominulo; inflorescentiis ♂ solis visis subterminalibus vel apices ramulorum versus axillaribus pyramidali-thyrsoideis multiramosis multifloris, 20–30 cm. longis et ad 15 cm. latis, breviter pedunculatis, rhachi crassa (basim versus 4–5 mm. diametro) subtereti primo cum ramis minute puberulis demum glabratis, ramis lateralibus 10–15 superne dichotome ramulosis, bracteis ovato-oblongis obtusis circiter 1 mm. longis; floribus sessilibus binis vel ternatis, bracteolis sub floribus oppositis circiter 0.5 mm. longis; calyce sub anthesi circiter 3 mm. diametro primo obscure puberulo mox glabrato, lobis 4 patentibus subcarnosis ovatis obtusis, 1–1.2 mm. longis

et 1.3–1.7 mm. latis; petalis 4 subcarnosis glabris obovato-oblongis, 4–4.5 mm. longis, 1.5–2 mm. latis, apice rotundatis; staminibus erectis, filamentis crassis 2–2.5 mm. longis, antheris ellipsoideis circiter 2 mm. longis apice minute mucronulatis; disco subnullo; ovarii rudimento subgloboso circiter 0.8 mm. diametro in stylum minutum angustato.

FIJI: VANUA LEVU: Mathuata: Southern base of Mathuata Range, north of Natua, alt. 100–250 m., Dec. 1, 1947, *Smith 6769* (A TYPE, US) (tree 15 m. high, in dense forest, the trunk about 15 cm. in diameter; petals and filaments white; anthers yellow).

The new species is striking for its very large leaves and ample inflorescences; it is closely related to the preceding, *F. vitiensis*, differing in the obvious vegetative characters mentioned in my key. In ♂ flowers the two species are nearly identical, *F. myriantha* having slightly broader calyx-lobes, shorter petals, and longer anthers than its ally, on the basis of the only collections now available.

Fagara myriantha is somewhat suggestive of Solomon Islands plants which have been referred to *Fagara rhetsa* Roxb., such as *Walker & White 126* (K) from Guadalcanal. Other material from the Solomons was referred to this species by Merrill and Perry (in Jour. Arnold Arb. **22**: 33. 1941, as *Zanthoxylum rhetsa* (Roxb.) DC.). Regardless of the identity of such specimens with *Fagara rhetsa*, the Fijian collection cannot be taken to represent the species as illustrated by Koorders and Valeton (Atlas Baumart. Java **2**: *fig. 352*. 1914), which is shown as having quite entire leaflets.

2. EVODIA J. R. & G. Forst.

The genus *Evodia*, although apparently not represented by many species in our region, is a common element of the vegetation in Fiji at all elevations and in many habitats. In Tonga the genus is represented only by the presumably introduced *E. hortensis*, and in Samoa by this common species and one endemic, *E. samoensis*. A satisfactory classification within the genus, in our region, is difficult, because of the elusiveness of usable taxonomic characters. Current herbarium identifications are not very helpful, and frequent use of the binomial *E. roxburghiana* for various forms (in both *Evodia* and *Acronychia*) has complicated matters. This binomial, in the sense of its type (*Zanthoxylum roxburghianum* Cham.), is considered to be a synonym of *Evodia lunur-ankenda* (Gaertn.) Merr. (see Merrill in Philip. Jour. Sci. Bot. 7: 373–378. 1912, for a very informative discussion of the complex synonymy of this and other confused entities). Christophersen (in Bishop Mus. Bull. **154**: 14. 1938) expressed the opinion that *E. lunur-ankenda* does not occur in Samoa; Merrill gives its range as India to the Malay Peninsula, Sumatra, and Java, and its occurrence in our region may be definitely discounted.

The most satisfactory — although minute — characters for differentiating our species lie in the disk. In three species (*E. samoensis*, *E. hortensis*, and *E. capillacea*), the disk is strictly glabrous and in pistillate

flowers forms a cup subtending the gynaecium; these species are readily distinguished from one another and do not present serious difficulties. Three other species, *E. cucullata* and two here described as new, have the disk copiously hispidulous-tomentellous, merely pulvinate and forming a minute gynophore in the pistillate flowers. This group of entities, endemic to Fiji, is taxonomically difficult, and the solution presented below, in which foliage characters are emphasized as the only tangible criteria, is not entirely satisfactory. Another Fijian species, *E. seemannii,* has the disk pulvinate and faintly puberulent, appearing glabrous except under high magnification; although intermediate in disk-characters, it is a readily recognized species.

In our region seven species of *Evodia* are believed discernible, three of them being further divided. Two species and two varieties are here proposed as new.

KEY TO THE SPECIES

Disk (in both ♂ and ♀ flowers) glabrous, in ♀ flowers pulvinate-cupuliform, the margin slightly upcurved and extending laterally beyond base of gynaecium.

Ovules 2 in each ovary-lobe; inflorescence comparatively large and many-flowered.

Leaves 3-foliolate, the petiole 6–18 cm. long, the leaflet-blades usually lanceolate, 9–22 × 4–11 cm., gradually acuminate at apex; young parts copiously puberulent-tomentellous; inflorescence broadly paniculate, 4–18 cm. long and nearly as broad; pedicels about 1 mm. long; style (in ♀ flowers) 2.5–3 mm. long; ovary-lobes glabrous or very sparsely hispidulous, free but closely appressed to each other; Samoa.....1. *E. samoensis.*

Leaves 1- or 3-foliolate, the petiole 1–7 cm. long, the leaflet-blades not exceeding 6.5 cm. in breadth; inflorescence obviously longer than broad; style (in ♀ flowers) not exceeding 2 mm. in length.

Leaflet-blades very diverse in shape, obtuse to short-acuminate at apex; young parts minutely sericeous; inflorescence narrowly paniculate, 7–30 cm. long, 1–5 (rarely 10) cm. broad; pedicels at anthesis 2–3 mm. long; style less than 1 mm. long; ovary-lobes glabrous, obviously separate; widespread species in cultivation or naturalized.....2. *E. hortensis.*

Leaflet-blades lanceolate, 7–17 × 1.5–5 cm., gradually narrowed to an acuminate apex; young parts obscurely puberulent, soon essentially glabrate; inflorescence paniculate, 4–12 cm. long, about half as broad as long; pedicels at anthesis less than 2 mm. long; style (in ♀ flowers) about 2 mm. long; ovary-lobes copiously but minutely puberulent, free but appressed to each other; Fiji.. .....4. *E. seemannii.*

Ovule single in each ovary-lobe; inflorescence comparatively few-flowered, 1–8 cm. long, the pedicels 2–4 mm. long; leaves small, 1- or 3-foliolate, the petiole 1–3.5 cm. long, the leaflet-blades lanceolate or ovate-lanceolate, 4–11 × 1.3–5.5 cm.; Fiji.....3. *E. capillacea.*

Disk (in both ♂ and ♀ flowers) hispidulous or tomentellous or puberulent, in ♀ flowers pulvinate, the margin not upcurved and hardly extending laterally beyond base of gynaecium; ovules 2 in each ovary-lobe; leaves 3-foliolate (very rarely 1-foliolate); Fijian species.

Indument of disk scarcely apparent, the hairs visible only with high magnification; ovary-lobes copiously but minutely puberulent; leaflet-blades lanceolate, 7–17 × 1.5–5 cm., acuminate at apex.....4. *E. seemannii.*

Indument of disk obvious, the hairs at least 0.1 mm. long.

Fruiting carpels strigillose-puberulent (hairs rarely obscuring the surface), usually essentially glabrate at maturity; leaflet-blades glabrous or inconspicuously puberulent on costa and secondaries beneath (hairs not more than 0.2 mm. long).

Leaflet-blades obovate or elliptic-obovate, sometimes elliptic, not exceeding 13.5 × 7 cm., usually considerably smaller, retuse at the rounded or broadly obtuse apex.....5. *E. cucullata.*

Leaflet-blades elliptic or oblong-elliptic, usually 6–20 × 3–11 cm., acuminate or cuspidate at apex (actual apex callose-tipped to rounded or faintly emarginate).....6. *E. vitiensis.*

Fruiting carpels very copiously and persistently hispidulous-puberulent (hairs pale, 0.1–0.2 mm. long); leaflet-blades lanceolate to ovate-lanceolate, 6–12 × 2.5–5.5 cm., gradually acuminate or cuspidate at apex and callose-tipped, hispidulous-tomentellous along costa and secondaries beneath (hairs pale, about 1 mm. long, usually persistent).....7. *E. evansensis.*

1. **Evodia samoensis** Christophersen in Bishop Mus. Bull. **154:** 12. *fig. 3,* as *Euodia s.* 1938.

Evodia roxburghiana sensu Reinecke in Bot. Jahrb. **25:** 642. 1898; Rechinger in Denkschr. Akad. Wiss. Wien **85:** 294. 1910; non Benth.

DISTRIBUTION: Endemic to Samoa, where it is to be expected on most of the islands. It most frequently occurs in open forest, at elevations of 75–550 m., being recorded as a tree of medium height (4–17 m. high), with greenish flowers. Recorded local names are *soopeni* (by Garber) and *fua pini* (by Reinecke); Christophersen comments that the first of these may be a misspelling of *so'opini.*

SAMOA: SAVAII: *Vaupel 221* (Feb. 16, 1906, NY, US) (Apr. 24, 1906, Bish); near Vaipouli, *Christophersen & Hume 1846* (Bish). UPOLU: *Reinecke 287* (Bish, BM, K, US); near Malololelei, *Christophersen 143* (Bish TYPE), *Wilder 419* (Bish). OFU: *Yuncker 9448* (Bish). OLOSENGA: Piumafua Mt., *Garber 1026* (Bish). TAU: Amouli trail, *Garber 617* (Bish, US); above Siufaga, *Yuncker 9193* (Bish). Samoa, without definite locality: *Whitmee* (GH).

This very distinct species has no close allies in our region, where it might be confused only with the Fijian species described below as *E. vitiensis;* from this, however, the glabrous disk and its different shape in pistillate flowers readily distinguish *E. samoensis.* In sterile condition *E. samoensis* can be mistaken for *Acronychia heterophylla,* although the two species differ in degree of indument on the young parts and in details of leaflet-shape and venation.

2. **Evodia hortensis** J. R. & G. Forst. Char. Gen. Pl. 14. *pl. 7,* as *Euodia h.* 1776.

DISTRIBUTION: Widespread in the Pacific and perhaps not native in our region. It is usually noted in cultivation or as an escape, rarely being found naturalized in more or less disturbed areas. In Fiji I have seen no indication that it is indigenous. It is commonly noted as a shrub or tree, usually less than 5 m. in height, at low elevations except where cultivated in hill villages. The flowers have white petals and a yellow disk, the fruits being green to light brown. Both foliage and inflorescences are strongly scented and pungent, the fragrance being often mentioned as "unpleasant" by collectors but apparently agreeable to natives of the region. The plant has a variety of uses in medicine (leaves chewed as a remedy for toothache and stomach pains, a remedial bath prepared from crushed leaves, a medicinal tea made from leaves, etc.) and ornamentation (inflorescences used to scent coconut oil). Local names are: *uthi, rauvula* (in Fiji); *usi, lau usi, usi-ulu* (in Samoa); *ohe, uhi* (in Tonga and Niue).

The Forsters' specimens of the species, from Tonga, include parts of both forms found in our region, with wide and narrow leaflets. The form with comparatively wide leaflets has been taken as typical by Lauterbach (in Bot. Jahrb. **55:** 231. 1918) and others who have used such a concept. Lauterbach's var. *typica* is made superfluous by recent nomenclatural legislation requiring repetition of the specific epithet for any type-including subdivision.

The two forms have essentially the same distribution, and the same local names and uses are accredited to both. Floral characters appear to be remarkably uniform throughout the species, but the leaves of the two forms are usually strikingly different. That some individuals bear both broad and narrow leaflets, as sometimes asserted (e. g. Seemann, Fl. Vit. 31. 1865), I am inclined to doubt, but it is true that leaf-form is very flexible in the species. Therefore the two elements of the population seem to merit recognition as forms rather than as varieties. They may be distinguished as follows:

Leaves 1- or 3-foliolate, the leaflet-blades usually 4–5 times as long as broad, 7–24 × (2–)2.5–6 cm., with 6–10(–14) curved-ascending lateral nerves. .....2a. f. *hortensis.*

Leaves 1-foliolate, the leaflet-blades usually 9–15 times as long as broad, 10–30 × 0.8–2.5 cm., with 15–30 or more short spreading lateral nerves. .....2b. f. *simplicifolia.*

2a. **Evodia hortensis** f. **hortensis.**

Evodia hortensis J. R. & G. Forst. Char. Gen. Pl. 14. *pl. 7,* as *Euodia h.* 1776; DC. Prodr. **1:** 724. 1824; A. Gray, Bot. U. S. Expl. Exped. **1:** 332. 1854; Seem. Fl. Vit. 30. 1865; Hemsl. in Jour. Linn. Soc. Bot. **30:** 171. 1894; Reinecke in Bot. Jahrb. **25:** 642. 1898; Burkill in Jour. Linn. Soc. Bot. **35:** 30. 1901; Rechinger in Denkschr. Akad. Wiss. Wien **85:** 293. 1910; Setchell in Carnegie Inst. Publ. **341:** 87. 1924; Christophersen in Bishop Mus. Bull. **128:** 106. 1935.

Fagara euodia L. f. Suppl. 125. 1781; Murr. Syst. Veg. 160, as *F. evodia.* 1784.

Zanthoxylum varians Benth. in Hook. Lond. Jour. Bot. **2:** 214. 1843.
Evodia hortensis var. *typica* Lauterb. in Bot. Jahrb. **55:** 231. 1918.

FIJI: VITI LEVU: *Seemann 91* (GH, K); Mba: Nalotawa, eastern base of Mt. Evans Range, *Smith 4329* (A, US); Nandronga & Navosa: Near Singatoka River, *Greenwood 832* (A, K, NY, US); Mbelo, near Vatukarasa, *Degener 15325* (A, Bish, K, NY, UC, US); Tunuve, Bemana district, *H. B. R. Parham 183* (BM); Rewa: Nukulau Island, *H. B. R. Parham 10* (BM). OVALAU: *Milne 255* (K); Levuka, *Prince* (GH), *Gillespie 4560* (Bish, GH, K, NY, UC, US). KANDAVU: Namalata Isthmus region, *Smith 6* (Bish, GH, K, NY, UC, US). VANUA LEVU: Mathuata: Undu Point, *Tothill 52b* (K); Thakaundrove: Savu Savu Bay region, *Degener & Ordonez 13863* (A, Bish, K, NY, UC, US); Maravu, near Salt Lake, *Degener & Ordonez 14131* (A, Bish, K, NY, UC, US). VANUA MBALAVU: Nambavatu, *Tothill 52* (K). MOALA: Naroi, *Smith 1404* (Bish, GH, K, NY, UC, US). MATUKU: *Bryan 256* (Bish). Fiji, without definite locality: *Hinds & Barclay* (K type of *Zanthoxylum varians*), *U. S. Expl. Exped.* (GH, NY), *Harvey* (GH, K), *Horne* (GH).

SAMOA: SAVAII: Matautu, *Vaupel 241* (Bish, K, US); Manase plantation, *Christophersen 674* (Bish, K, NY, US), *Christophersen & Hume 1979* (Bish, K, NY, UC, US). UPOLU: Vaea, *Bryan 98* (Bish); near Apia, *Reinecke 210* (Bish, K, US), *Eames 153* (Bish, UC); Vaiele, *Eames 167* (Bish). TUTUILA: Papatele trail, *Setchell 268* (UC); near Pago Pago, *Garber 931* (Bish, K, NY). Samoa, without definite locality: *U. S. Expl. Exped.* (NY, US), *Powell* (K), *287* (GH, K), *303* (K), *Whitmee 39* (K).

TONGA: VAVAU: *Moore 499* (K); near Talau hill, *MacDaniels 1100* (Bish). VAVAU and LIFUKA: *Harvey* in part (K). TONGATABU: Near Kologa, *Setchell & Parks 15361* (Bish, K, UC, US). Tonga, without definite locality: *J. R. & G. Forster* (BM TYPE, K in part), *Harvey* in part (K), *Crosby* in part (K).

2b. **Evodia hortensis** f. **simplicifolia** (Rechinger) K. Schum. ex Lauterb. in Bot. Jahrb. **55:** 232. 1918; Christophersen in Bishop Mus. Bull. **128:** 106, as *Euodia h.* f. *s.* 1935; Yuncker in Bishop Mus. Bull. **178:** 67. 1943.

Euodia longifolia A. Rich.; A. Gray, Bot. U. S. Expl. Exped. **1:** 332. 1854; Seem. in Jour. Bot. **2:** 71, as *Evodia l.* 1864.

Evodia hortensis var. *simplicifolia* Rechinger in Denkschr. Akad. Wiss. Wien **85:** 294. 1910; Setchell in Carnegie Inst. Publ. **341:** 87. 1924.

TYPE LOCALITY: As type of his variety, Rechinger indicates his no. *3735*, from Vaipouli, Savaii, Samoa. Although I have not seen this collection, it obviously represents the narrow-leaved form of the species. Lauterbach's discussion of *E. hortensis* (in 1918) is confusing, and one cannot be sure that his f. *simplicifolia* is intended to be based upon Rechinger's var. *simplicifolia*. I follow Christophersen and Yuncker in their interpretation of the trinomial as a new combination.

FIJI: TAVEUNI: Somosomo, *Seemann 92* (GH, K). MOALA: Naroi, *Smith 1403* (Bish, GH, K, NY, UC, US). Fiji, without definite locality: *U. S. Expl. Exped.* (GH), *Milne 152* (K), *Graeffe* (K).

SAMOA: SAVAII: Saipipi, *Christophersen 923* (Bish); near Safune, *Christophersen & Hume 2434* (Bish, K, NY, UC, US). TUTUILA: "*From*

J. G. Veitch" (K); Utomea, near Leone, *Setchell* (coll. *Collarino*) *556* (Bish, UC); Pago Pago, *Wilder 83* (Bish); Nuuuli, *Garber 960* (Bish); Aua, *Bryan 964* (Bish). OFU: Near Ofu, *Yuncker 9446* (Bish). Samoa, without definite locality: *U. S. Expl. Exped.* (GH, K, NY, US), *Powell 303* (K), *Whitmee 38* (K).

TONGA: VAVAU and LIFUKA: *Harvey* in part (K). TONGATABU: Near Nukualofa, *Setchell & Parks 15175* (UC). EUA: *Lister* (K); plateau and Houma districts, *Parks 16189* (Bish, GH, K, NY, UC, US). Tonga, without definite locality: *J. R. & G. Forster* in part (K), *Mathews 123* (K), *Harvey* in part (K), *Crosby* in part (K), *McKern 44* (Bish), *112* (Bish).

NIUE: Alofi, *Yuncker 9819* (DP).

3. **Evodia capillacea** Gillespie in Bishop Mus. Bull. **91**: 10. *fig. 10.* 1932.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Taveuni at high elevation (950–1220 m., with the exception of *Degener 15195*, collected at 150 m.). The species seems to be a rare component of upland forest or dense crest thickets; it is a shrub or slender tree 3–5 m. in height. Color notes indicate that the petals are white or yellowish, sometimes pink-tinged without, the filaments white, the anthers and ovary pale yellow, the fruit purple-tinged, and the seed black. The only local name recorded (*Smith 4992*) is *velivelitambua*.

FIJI: VITI LEVU: Mba: Vicinity of Nandarivatu, along the Mba road, *Gillespie 4046* (Bish TYPE, GH); ridge between Mt. Nanggaranambuluta [Lomalangi] and Mt. Namama, east of Nandarivatu, *Smith 4992* (A, US); Serua: Vatutavathe, near Ngaloa, *Degener 15195* (A, Bish, K, NY, UC, US); Namosi: Summit of Mt. Vakarongasiu, *Gillespie 3259* (Bish, GH, UC). TAVEUNI: Summit of Mt. Uluingalau, *Smith 892* (Bish, GH, K, NY, UC, US).

Evodia capillacea is a remarkable species for several reasons, being distinct from all other *Evodiae* in our region in having a single ovule ascending from the inner angle of each ovary-lobe, a fact clearly observed in each of the five available collections, all of which bear fertile ovaries. In the other species here discussed the ovules are always paired and superposed. It may be assumed that *E. capillacea* is polygamo-dioecious, although no strictly staminate flowers have been observed. *Gillespie 3259* and *Degener 15195* bear perfect flowers, with both ovaries and anthers clearly fertile; *Smith 892* and *4992* (and presumably also the type) bear pistillate flowers, with anthers developed but apparently sterile. The species is further distinguished by its very much reduced, few-flowered inflorescences and its small leaves. The Viti Levu specimens have either predominantly 1-foliolate leaves (*Gillespie 3259, Degener 15195*) or mixed 1- and 3-foliolate leaves (*Gillespie 4046, Smith 4992*). The Taveuni specimen (*Smith 892*) has the leaves apparently always 3-foliolate; this specimen further differs from the Viti Levu material in having the ovary strictly glabrous instead of hispidulous- or strigillose-puberulent. On the basis of available material I do not feel justified in proposing nomenclatural status for the Taveuni plant.

4. **Evodia seemannii** Gillespie in Bishop Mus. Bull. 91: 12. *fig. 12*, as *E. seemanni*. 1932.

Evodia drupacea sensu Seem. Fl. Vit. 30. 1865, p. p.; non Labill.

DISTRIBUTION: Endemic to Fiji and apparently uncommon, known only from Viti Levu and Vanua Levu, at altitudes from near sea-level (*Parham 166*) up to 1050 m. It has been noted as a shrub or slender tree 4–10 m. high, in dense forest or dry forest; the petals and filaments are cream-white. Recorded local names are *ndrautolu* and *tokatolu* (Viti Levu), and *salusalu rakalava* (Mbua).

FIJI: VITI LEVU: Mba: Slopes of Mt. Nairosa, eastern flank of Mt. Evans Range, *Smith 4022* (A, US); Nandarivatu, *Gillespie 3713* (Bish, UC); western slopes of Mt. Nanggaranambuluta [Lomalangi], east of Nandarivatu, *Greenwood 869* (A, K), *Smith 4769* (A, US); Naitasiri: Nanduruloulou, *B. E. Parham 166* (A). VANUA LEVU: Mbua: Southern portion of Seatovo Range, *Smith 1707* (Bish, GH, K, NY, UC, US); Mathuata: *Seemann 90* (GH TYPE, K).

This very distinct species is readily recognized by its usually 3-foliolate leaves, with lanceolate and acuminate leaflet-blades, by its very closely puberulent or glabrate young parts and inflorescences, and by the minute indument of its disk and ovary. In the available material, good flowers accompany the type, *Parham 166*, and *Smith 1707;* all flowers dissected are either pistillate or perfect, the anthers at least sometimes being obviously fertile.

In accordance with recent nomenclatural legislation, Gillespie's epithet *seemanni* is considered an orthographic variant which should be corrected to *seemannii*.

5. **Evodia cucullata** Gillespie in Bishop Mus. Bull. 91: 10. *fig. 11*. 1932.

In his original description of this entity, Gillespie cites eight of his own collections and also implies that it includes the Exploring Expedition collection which Gray referred to *E. drupacea*. Gillespie was aware that his concept as thus outlined was very broad, and he suspected that the larger-leaved specimens from Taveuni might not belong in the same species as typical material from Viti Levu. After study of a fairly extensive series of specimens, I must verify Gillespie's implication that the Fijian material of this immediate affinity is very uniform in floral and fruit characters. *Evodia cucullata*, in the broad sense accepted by its author, would have to be accepted, without regard for foliage characters, as the Fijian population of *Evodia* with a pulvinate and copiously hispidulous-tomentellous disk. The vegetative extremes of this population, however, are so diverse that I think they cannot conveniently be left in a single species. A few specimens (not known to Gillespie) from the isolated Mt. Evans Range of Viti Levu have copiously and persistently pilose carpels and usually conspicuous indument on the nerves of the lower surfaces of leaflets; this entity I describe below as *E. evansensis*. The (nomenclaturally) typical element of Gillespie's species is represented, among the specimens cited, by only nos. *3198* and *3743;* this element

seems restricted to higher elevations (above 700 m.) on the larger islands. A lowland variant, with larger but similarly rounded and emarginate leaflets, is described below as var. *robustior;* this does not seem to occur above 500 m. altitude, and it is more often found near sea-level.

The rest of the population of this immediate alliance, with leaflets which are acuminate or cuspidate at apex, I describe as *E. vitiensis*. In its larger-leaved phase (var. *vitiensis*), this species is very different in foliage from *E. cucullata,* but a smaller-leaved variant (var. *minor*) resembles *E. cucullata* var. *robustior* in size (but not in apex) of leaflets. The division of this complex population into two species, each with two varieties, is not very satisfactory, since the elements here recognized may be inter-fertile. The typical forms of *E. cucullata* and *E. vitiensis* are very distinct, although occurring in the same area. In their atypical varieties, however, the two species approach each other in foliage characters.

The two recognized varieties of *E. cucullata* may be distinguished as follows:

Petioles 1.5–5 cm. long; leaflet-blades usually 4–8 × 2–3.7 cm., with 6–9 pairs of secondary nerves; shrub or tree 2–5 m. high, occurring at elevations of 700–1220 m.....5a. var. *cucullata.*

Petioles (2.5–)3–7.5 cm. long; leaflet-blades usually 6–13.5 × 2.5–7 cm., with 7–12 pairs of secondary nerves; usually a tree 5–13 m. high, rarely a smaller shrub, occurring at elevations of sea-level to 500 m.....5b. var. *robustior.*

5a. **Evodia cucullata var. cucullata.**

Evodia cucullata Gillespie in Bishop Mus. Bull. **91:** 10. *fig. 11.* 1932.

DISTRIBUTION: Fiji, thus far known from Viti Levu, Vanua Levu, and Taveuni, at elevations of 700–1220 m., occurring in various types of forest, in hillside thickets, or in dense crest vegetation. It has been noted as a shrub or slender tree 2–5 m. high, with white petals and filaments; the petals sometimes have noticeable greenish glands. A local name is *ndrautolu.*

FIJI: VITI LEVU: Mba: Vicinity of Nandarivatu, *Gillespie 3743* (Bish, GH), *Degener & Ordonez 13609* in part (NY); slopes of Mt. Nanggaranambuluta [Lomalangi], *Gillespie 3198* (Bish TYPE, GH, K, NY, UC), *B. E. Parham 2146* (A); slopes of the escarpment north of Nandarivatu, *Smith 6086* (A, US). VANUA LEVU: Mbua: Summit of Mt. Seatura, *Smith 1675* (Bish, GH, K, NY, UC, US); Thakaundrove: Summit of Mt. Mbatini, *Smith 686* (Bish, GH, K, NY, UC, US). TAVEUNI: Borders of lake east of Somosomo, *Smith 872* (Bish, GH, K, NY, UC, US); summit of Uluingalau, *Smith 894* (Bish, GH, K, NY, UC, US).

The available specimens seem to be strictly dioecious. The following bear staminate flowers: *Gillespie 3198, 3743, Parham 2146, Smith 686, 872, 6086.* My no. *1675* is in fruit, while no. *894* and *Degener & Ordonez 13609* have pistillate flowers. The pistillate flowers have stamens superficially like those of staminate flowers, but no pollen was detected; the disk in pistillate flowers is inconspicuous, pulvinate, and minutely hispidulous; the ovary is deeply 4-lobed and minutely puberulent-sericeous,

each lobe being 2-ovulate; the style is stout, 1.3–1.5 mm. long, enlarging distally into a capitate stigma about 1 mm. in diameter.

5b. **Evodia cucullata** var. **robustior** var. nov.

Arbor (raro frutex) 5–13 m. alta, a var. *cucullata* petiolis longioribus, foliolorum laminis majoribus nervis secundariis numerosioribus differt; petiolis (2.5–)3–7.5 cm. longis, petiolulis lateralibus 2–10 mm. terminalibus ad 15 mm. longis, foliolorum laminis ellipticis vel elliptico-obovatis, (5–)6–13.5 cm. longis, (2–)2.5–7 cm. latis, apice rotundatis et manifeste emarginatis, nervis secundariis utrinsecus 7–12 patentibus; inflorescentiis 3–7 cm. longis et paullo angustioribus, pedicellis sub fructu juvenili 2–3 mm. longis.

DISTRIBUTION: Fiji, known from several of the islands, at elevations from sea-level to 500 m. A variety of habitats is recorded, including forest on limestone, open forest, thickets, and among reeds. The plant is usually a tree 5–13 m. high, but one specimen (*Smith 1505*) was noted as a gnarled shrub 0.5 m. high on limestone cliffs, in a very exposed location. Local names are *ndrautolu* and *tokatolu* (more or less generic in Fiji), and *nggaringgarikalavu* (Mathuata). Degener (no. *15047*) noted that a medicinal tea is prepared from the fresh or dried leaves. Most of the specimens are in fruit, but young staminate inflorescences accompany my nos. *6372* and *6568*. The young petals are pale yellow, and the staminate flowers do not materially differ from those of var. *cucullata*. Since the most mature flowers occur on no. *6372*, that collection is indicated below as the type of the new variety.

FIJI: VITI LEVU: Nandronga & Navosa: Mbulu, near Sovi Bay, *Degener 15047* (A, Bish, K, NY); Naitasiri or Rewa: Central Road, near Suva, *Tothill F514* (Bish, K). MBENGGA: Ndakuni, *B. E. Parham & P. Turaga 2083* (A). VANUA LEVU: Mathuata: Southern slopes of Mt. Numbuiloa, east of Lambasa, Oct. 27, 1947, *Smith 6372* (A TYPE, US); same locality, *Smith 6568* (A, US); Thakaundrove: Yanawai River region, Mt. Kasi, *Smith 1778* (Bish, GH, K, NY, UC, US). KORO: East coast, *Smith 1041* (Bish, GH, K, NY, UC, US). VANUA MBALAVU: Northern limestone section, *Smith 1505* (Bish, GH, K, NY, UC, US); southern limestone section, Malatta islet, *Smith 1436* (Bish, GH, K, NY, UC, US). KAMBARA: On limestone formation, *Smith 1251* (Bish, GH, K, NY, UC, US). Fiji, without definite locality: *Seemann 102* in part (K), *103* in part (GH).

6. **Evodia vitiensis** sp. nov.

Arbor (vel raro frutex) 2–14 m. alta, ramulis robustis subteretibus, internodiis distalibus plus minusve quadrangularibus vel complanatis, partibus juvenilibus copiose cinereo-puberulis mox subglabratis; foliis oppositis trifoliolatis, petiolo (1.5–)2–13 cm. longo subtereti vel supra complanato ut ramulis petiolulisque inconspicue puberulo, petiolulis lateralibus 1–15 mm. terminalibus ad 17 mm. longis; foliolorum laminis papyraceis in sicco plerumque fusco-viridibus copiose sed saepe obscure glanduloso-punctatis, ellipticis vel oblongo-ellipticis, (5–)6–20 cm. longis, (2.5–)3–11 cm. latis, basi obtusis vel subacutis, apice acuminatis vel

cuspidatis (apice ipso saepe 5–15 mm. longo calloso-apiculato interdum rotundato vel leviter emarginato), margine saepe anguste recurvatis et undulatis, utrinque glabris vel subtus costa et nervis inconspicue puberulis, costa supra subplana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 7–13 patentibus supra subplanis subtus elevatis, rete venularum intricato subtus prominulo; inflorescentiis axillaribus paniculatis multifloris pedunculo ad 4 cm. longo incluso ad 11 cm. longis latisque, ramulis pedicellisque copiose puberulis vel puberulo-tomentellis (pilis cinereo-fulvis circiter 0.1 mm. longis); pedicellis gracilibus teretibus sub anthesi 0.7–2 mm. longis; calyce cupuliformi sub anthesi 1.5–2 mm. diametro parce luteo-glanduloso ut pedicellis puberulo vel glabrato profunde 4-lobato, lobis ovato-deltoideis 0.6–1 × 0.7–1.4 mm. apice subacutis vel rotundatis; petalis 4 submembranaceis vel tenuiter carnosis parce glanduloso-punctatis glabris oblongis vel oblongo-ellipticis, 1.8–2.5 mm. longis, 1–1.6 mm. latis, apice obtusis vel subacutis et minute cucullatis; staminibus 4, filamentis ligulatis glabris 1.3–3.5 mm. longis, antheris oblongis 0.6–1 mm. longis apice rotundatis, in floribus ♀ sterilibus; disco in floribus ♂ pulvinato obscure lobato 0.3–0.5 mm. alto 1–1.3 mm. diametro pilis fulvis 0.2–0.4 mm. longis copiose hispidulo-tomentello, ovario sterili minuto in disco immerso vel subnullo, stylorum vestigiis 4 laxe connatis minutis vel nullis; disco in floribus ♀ subsimili stipitiformi, ovario profunde 4-lobato ut disco piloso vel puberulo vel glabro, lobis biovulatis, ovulis oblique superpositis, stylo crasso tereti 0.8–1.5 mm. longo inferne strigilloso vel glabro, stigmate peltato-capitato 4-lobato 0.8–1 mm. diametro; pedicellis sub fructu ad 4 mm. longis, calyce persistente, disco manifeste hirtello; fructus carpellis subliberis (1, 2, vel 3 interdum abortis) puberulis vel glabratis copiose luteo-glandulosis obovato-ellipsoideis, plerumque 4–4.5 mm. longis et 2.5–3 mm. latis, apice rotundatis, seminibus 2 (vel 1) nigris levibus nitidis ellipsoideo-subglobosis 2.5–3 mm. longis latisque.

DISTRIBUTION: Fiji, known from several of the islands and probably to be expected throughout the group. It appears to be the most abundant Fijian species of the genus. As type of the species I designate my no. *6176*, of which numerous duplicates are available, a collection from Viti Levu with young staminate inflorescences.

The concept outlined by the above description is hardly to be distinguished in inflorescence from *E. cucullata,* but, as discussed above under that species, it seems too different in foliage to be considered conspecific. *Evodia vitiensis* may be divided into two varieties, distinguishable as follows:

Petioles (2.5–)4–13 cm. long; leaflet-blades usually 8–20 × 4–11 cm., the apex 5–15 mm. long, usually callose-tipped, rarely faintly emarginate; inflorescence 4.5–11 cm. long.....6a. var. *vitiensis.*

Petioles (1.5–)2–6.5 cm. long; leaflet-blades usually 6–12 × 3–6 cm., the apex cuspidate or short-acuminate, usually faintly emarginate; inflorescence 2–6(–9) cm. long.....6b. var. *minor.*

6a. **Evodia vitiensis var. vitiensis.**

Evodia roxburghiana sensu Seem. Fl. Vit. 31. 1865, p. p.; non Benth.

DISTRIBUTION: Fiji, known from several islands at elevations of 100–1150 m., occurring as a tree 2–13 m. high in various types of forest or in hillside thickets; the petals are white to pale yellow. Recorded local names are *ndrautolu* (general), *kai tambua* (upland Viti Levu), and *vure* (Moala).

FIJI: VITI LEVU: Mba: Vicinity of Nandarivatu, *Parks 20791* (Bish, UC), *Degener & Ordonez 13609* in part (A); Mt. Nanggaranambuluta [Lomalangi], *Gillespie 4062* (Bish, UC); hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, Sept. 22, 1947, *Smith 6176* (A TYPE, US); slopes of the escarpment north of Nandarivatu, *Smith 6069* (A, US); valley of Nandala Creek, south of Nandarivatu, *Degener 14282* (A, Bish, K, NY, UC, US), *14393* (A, NY), *14547* (A, Bish, K, NY, UC, US); valley of Nggaliwana Creek, *Smith 5336* (A, US); hills between Nggaliwana and Tumbeindreketi Creeks, *Smith 5867* (A, US); Navai valley, near Vunindawa trail, *Gillespie 4133* (Bish, GH, K, NY, UC); southern slopes of Mt. Tomanivi [Mt. Victoria], *Smith 5215* (A, US); Naitasiri: Vicinity of Nasinu, *Gillespie 3439* (Bish, GH, UC, US). KANDAVU: Hills above Namalata and Ngaloa Bays, *Smith 104* (Bish, GH, K, NY, UC, US). TAVEUNI: Vicinity of Wairiki, *Gillespie 4803* (Bish, GH, UC). MOALA: Near Naroi, *Smith 1312* (Bish, GH, K, NY, UC, US). Fiji, without definite locality: *Seemann 102* in part (K).

6b. **Evodia vitiensis var. minor** var. nov.

Evodia drupacea sensu A. Gray, Bot. U. S. Expl. Exped. **1:** 332. 1854; Seem. Fl. Vit. 30. 1865, p. p.; non Labill.

Evodia roxburghiana sensu Seem. Fl. Vit. 31. 1865, p. p.; non Benth.

Arbor (raro frutex) ad 14 m. alta, a var. *vitiensi* petiolis brevioribus, foliolorum laminis minoribus apice brevius acuminatis vel cuspidatis plerumque leviter emarginatis, inflorescentia breviore differt; petiolis (1.5–)2–6.5 cm. longis, foliolorum laminis (5–)6–12(–14) cm. longis, (2.5–)3–6 cm. latis; inflorescentiis 2–6 cm. longis latisque vel raro ad 9 cm. longis.

DISTRIBUTION: Fiji, thus far known from Viti Levu, Vanua Levu, and Taveuni, at elevations from near sea-level to 1100 m. It has been noted as a tree 4–14 m. high (rarely as a shrub 2 m. high) in forest, woods, and thickets, with white or pale yellow petals. Local names are *ndrautolu* (general), *nggaringgarikalavu* (on Taveuni), and *kai tambua* (upland Viti Levu). As type I indicate my no. *325*, from Thakaundrove, Vanua Levu, a collection with well developed staminate inflorescences, of which duplicates are widely distributed.

FIJI: VITI LEVU: Mba: Mt. Evans Range, east of Lautoka, *Greenwood 387* (K), *1088* (A, Bish); between Mba and Tavua, *Greenwood 797* (K); Naitasiri: Northern portion of Rairaimatuku Plateau, between Mt. Tomanivi and Nasonggo, *Smith 6089* (A, US); Nandronga & Navosa: Southern slopes of Nausori Highlands, in drainage of Namosi Creek above Tumbenasolo, *Smith 4711* (A, US). VANUA LEVU: Mbua: Southern portion of Seatovo Range, *Smith 1527* (Bish, GH, K, NY, UC, US); Mathuata: Hills near Lambasa, *Greenwood 574* (K), *574A* (K); Mathuata coast, *Greenwood 574B* (K); Seanggangga Plateau,

vicinity of Natua, *Smith 6745* (A, US); Undu Point, *Tothill 53* (K); Thakaundrove: Hills south of Nakula Valley, *Smith 325* (Bish, GH, K, NY, UC, US 1676076 TYPE); Maravu, near Salt Lake, *Degener & Ordonez 14194* (A, Bish, K, NY, UC, US). TAVEUNI: *Seemann 103* (GH in part, K); vicinity of Waiyevo, *Gillespie 4638* (Bish, GH, K, NY, UC, US); western slope, between Somosomo and Wairiki, *Smith 762* (Bish, GH, K, NY, UC, US); vicinity of Wairiki, *Gillespie 4673* (Bish, UC). Fiji, without definite locality: *U. S. Expl. Exped.* (GH, US 15051), *Horne 289* (GH).

7. **Evodia evansensis** sp. nov.

Arbor 4–10 m. alta, ramulis fuscis subteretibus, internodiis distalibus subcomplanatis, partibus juvenilibus copiose cinereo-puberulis, demum glabratis; foliis oppositis trifoliolatis, petiolo 3.5–7 cm. longo subtereti vel inconspicue canaliculato ut ramulis petiolulisque puberulo et demum glabrato, petiolulis lateralibus 2–5 mm. terminalibus 8–15 mm. lōngis; foliolorum laminis papyraceis inconspicue immerso-glandulosis in sicco fusco-viridibus, lanceolatis vel ovato- vel obovato-lanceolatis, 6–12 cm. longis, 2.5–5.5 cm. latis (lateralibus quam terminali paullo minoribus interdum 5 × 2 cm.), basi acutis, apice gradatim acuminatis vel obtuse cuspidatis et calloso-apiculatis, margine saepe inconspicue recurvatis, supra glabris vel evanescenter puberulis, subtus secus costam et nervos pilis circiter 1 mm. longis hispidulo-tomentellis vel tantummodo puberulis (pilis longioribus paucis plerumque persistentibus), costa supra plana vel leviter impressa subtus prominente, nervis secundariis utrinsecus 7–10 erecto-patentibus supra subplanis subtus elevatis, rete venularum subimmerso; inflorescentiis sub fructu solis visis axillaribus late paniculatis pedunculo brevi incluso 5–13 cm. longis latisque, ramulis gracilibus minute puberulis, pedicello sub fructu gracili tereti 2.5–4 mm. longo pilis pallidis ad 0.1 mm. longis dense puberulo; calyce persistente rotato 2.5–3 mm. diametro ut pedicello copiose puberulo profunde 4-lobato, lobis deltoideis circiter 1 × 1.3 mm. subacutis; petalis caducis; staminibus subpersistentibus 4, filamentis ligulatis glabris 0.5–1 mm. longis, antheris ellipsoideis 0.4–0.5 mm. longis apice rotundatis ut videtur sterilibus; disco sub fructu inconspicuo pilis 0.1–0.15 mm. longis copiose hispidulo; fructus carpellis subliberis (1, 2, vel 3 interdum abortis) copiose et persistenter hispidulo-puberulis (pilis pallidis 0.1–0.2 mm. longis), ellipsoideis, 6–9 mm. longis, 5–7 mm. latis, apice rotundatis, seminibus 1 vel 2 (ovulis in carpellis juvenilibus semper 2) nigris levibus nitidis ellipsoideis, 5–7 mm. longis, 4–5.5 mm. latis.

DISTRIBUTION: Fiji, known only from the isolated Mt. Evans Range in northwestern Viti Levu, at an altitude of 950–1195 m.

FIJI: VITI LEVU: Mba: Eastern slopes of Mt. Koroyanitu, Mt. Evans Range, May 2, 1947, *Smith 4241* (A TYPE, US) (tree 10 m. high, in dense low forest); summit of Mt. Koroyanitu, high point of range, *Smith 4205* (A, US) (*ndrautolu;* tree 8 m. high, in dense ridge forest and thickets); near summit of Mt. Evans Range [Mt. Mbotilamu], *Greenwood 323* (K) (tree 4 m. high, the very young flower-buds white).

Although the species here described is obviously a close relative of *E. cucullata* and *E. vitiensis*, the dense and persistent indument of the fruiting carpels and the characteristic hairs on the lower surfaces of leaflets sharply distinguish it. It is noted that fruits and seeds of the new species are considerably larger than those of its two relatives, but this character is perhaps not very significant.

3. ACRONYCHIA J. R. & G. Forst.

The species of *Acronychia* in our region, although few, are extremely difficult to characterize. Whereas in *Evodia* the complex species are Fijian, in *Acronychia* they are Samoan. The single Fijian species, *A. petiolaris*, is the most distinct in the region, and the single species known from Tonga and Niue, *A. niueana*, is also fairly well characterized. However, the Samoan population demonstrates no inflorescence differentiation of consequence, and for specific delimitation it seems necessary to rely entirely upon foliage characters, flexible and unsatisfactory as these are.

Seven species are recognized in our region, all of them having been adequately described.

KEY TO THE SPECIES

Disk (in both ♂ and ♀ flowers) glabrous; filaments (in both ♂ and ♀ flowers) broadly ligulate, conspicuously ciliolate for most of length; flowers subsessile (pedicels minute even in fruit), with copiously sericeous-puberulent calyx and petals; fruit indehiscent, very thick-walled, persistently pilose; leaves 1-foliolate, the petiole usually 2–4.5 cm. long; Fiji.....1. *A. petiolaris.*

Disk (in both ♂ and ♀ flowers) hispidulous or strigillose with hairs 0.1–0.3 mm. long (merely puberulent in no. 4); filaments glabrous or pilose proximally, not uniformly ciliolate; flowers pedicellate (pedicels at anthesis rarely 1 mm. long, usually longer); mature fruit obscurely puberulent or glabrate, comparatively thin-walled, dehiscent; Samoa, Tonga, and Niue.

Leaves 1-foliolate, comparatively small, the petiole 0.4–2(–2.3) cm. long, the leaflet-blade usually obovate or oblanceolate, 3–10 × 1.5–4.2 cm., obtuse and minutely apiculate at apex; inflorescence compact, few-flowered, scarcely exceeding 1 cm. in length at anthesis; Samoa.....2. *A. richii.*

Leaves 1- or 3-foliolate, the petiole more than 1.5 cm. long (rarely 1 cm., usually more than 2 cm.), the leaflet-blades 5–19 × 3–10 cm., rarely smaller; inflorescence at anthesis rarely less than 2 cm. long.

Leaflet-blades (leaves always 1-foliolate) elliptic to obovate, rounded at apex and often obviously retuse.

Disk hispidulous or strigillose with hairs 0.1–0.2 mm. long; filaments hispidulous, especially on margins, near base; pedicels in fruit 1.5–2 mm. long, the capsule 3–4 mm. high, the seeds 2.5–3 mm. long; leaflet-blades 5–15 × 3–7.5 cm., with 6–9 secondary nerves; Samoa.....3. *A. retusa.*

Disk hispidulous-puberulent with hairs less than 0.1 mm. long; filaments glabrous or obscurely ciliolate toward base; pedicels in fruit 2–5 mm. long, the capsule 5–6 mm. long, the seeds about 4 mm. long; leaflet-blades 9–19 × 3.5–10 cm., with 7–15 secondary nerves; Tonga and Niue.....4. *A. niueana.*

Leaflet-blades usually acuminate or gradually narrowed toward apex (actual apex sometimes rounded or obtuse, occasionally faintly emarginate); Samoan species.

Leaves 1-foliolate, the single leaflet essentially sessile at the apical articulation of petiole (i.e. petiolule 0–3 mm. long); leaflet-blades obtuse to acute at base, with 10–15 secondary nerves; known only from Savaii.....5. *A. boweriana.*

Leaves usually 3-foliolate but sometimes 1-foliolate and then with the single leaflet obviously petiolulate above the apical articulation of petiole; petiolules of terminal leaflet 3–28 mm. long, of lateral leaflets 2–22 mm. long; leaflet-blades attenuate at base and decurrent on the petiolule, with 6–13 secondary nerves.

Leaflet-blades lanceolate, oblanceolate, or narrowly elliptic, about 3 times as long as broad, usually 7–15 × 2.5–5.5 cm. (rarely to 22 × 8 cm.), the secondary nerves 6–10 per side, spreading from the costa at an angle of 60–80°; known only from Savaii and Upolu.....6. *A. albiflora.*

Leaflet-blades elliptic, obovate-elliptic, or lanceolate-elliptic, about twice as long as broad, usually 7–19 × 4–9 cm., the secondary nerves 6–13 per side, erecto-patent, forming an angle of 55–65° with the costa; known only from Tutuila...7. *A. heterophylla.*

1. **Acronychia petiolaris** A. Gray, Bot. U. S. Expl. Exped. 1: 335. *pl. 33, A.* 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 416. 1857; Seem. Fl. Vit. 31. 1865; Gibbs in Jour. Linn. Soc. Bot. 39: 142. 1909.

DISTRIBUTION: Endemic to Fiji and thus far known only from Viti Levu and Vanua Levu, at elevations of 60–970 m. It is usually a slender tree 5–12 m. high, sometimes a shrub 2–5 m. high, occurring in various types of forest or thickets; in Mathuata it is a typical component of patches of dry forest in prevailingly open country. The petals and filaments are white, greenish white, or pale yellow, and the anthers are yellow. Recorded local names are *mariko* and *kai singa* (Nandarivatu region), *ndongotuva* (Mbua), and *nggaringgarikalavu* (Mathuata). Mead has noted that the wood is used for house-building in the vicinity of Nandarivatu.

FIJI: VITI LEVU: Mba: Vicinity of Nandarivatu, *Parks 20710* (Bish, UC), *Gillespie 3984* (Bish, GH, NY, UC), *4311* (Bish, GH, K, UC, US), *Tothill 54* (K), *Mead 1987* (K); southern slopes of Mt. Ndelainathovu, on the escarpment west of Nandarivatu, *Smith 4934* (A, US); hills between Nandala and Nukunuku Creeks, along trail from Nandarivatu toward Lewa, *Smith 6150* (A, US); Sovutawambu, south of Nandarivatu, *Degener 14652* (A, Bish, K, NY, UC, US). VANUA LEVU: Mbua: *Horne 1114* (GH, K); southern portion of Seatovo Range, *Smith 1702* (Bish, GH, K, NY, UC, US); Mathuata: Mathuata coast, *U. S. Expl. Exped.* (GH, US 15292 TYPE); vicinity of Lambasa, *Greenwood 566* (K); southern slopes of Mt. Numbuiloa, east of Lambasa, *Smith 6407* (A, US); southern base of Mathuata Range, north of Natua, *Smith 6779* (A, US); Seang-

gangga Plateau, in drainage of Korovuli River, vicinity of Natua, *Smith 6711* (A, US), *6728* (A, US); Wainunu-Ndreketi divide, *Smith 1841* (Bish, GH, K, NY, UC, US). Fiji, without definite locality: *Horne 599* (GH, K).

Of the species of *Acronychia* in our region, *A. petiolaris*, the only Fijian species, is the most distinct in fundamental characters. It differs from the species of Samoa, Tonga, and Niue in having a thick-walled, indehiscent, persistently pilose fruit. As indicated by my key, it also differs from its congeners in its glabrous disk, conspicuously ciliolate filaments (which are as fully developed in ♀ as in ♂ flowers), unusually densely pilose petals, and subsessile flowers. Other Fijian material which had been referred to *Acronychia* in herbaria proves, upon more careful examination, to belong in either *Melicope* or *Evodia*.

Gillespie has identified his and Parks' specimens, cited above, as *A. baueri* Schott (1834), and that Australian species is indeed very suggestive of *A. petiolaris* in facies and even in such floral details as the conspicuously ciliolate filaments. However, *A. baueri* has the calyx-lobes definitely oblong rather than deltoid, the disk (in both ♂ and ♀ flowers) pulvinate-cupuliform and with its upcurved margins extending laterally beyond the base of the ovary (rather than merely stipitiform), and the fruit somewhat angled, with a thinner pericarp, and probably tardily dehiscent (rather than round in cross-section, very thick-walled, and apparently not dehiscent even at full maturity). However, the Fijian plant is certainly more closely allied to *A. baueri* than it is to any of the Samoan species of the genus.

2. **Acronychia richii** A. Gray, Bot. U. S. Expl. Exped. 1: 336. *pl. 33, B.* 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 416. 1857; Lauterb. in Bot. Jahrb. 41: 228. 1908; Christophersen in Bishop Mus. Bull. 128: 109. 1935.

DISTRIBUTION: Samoa, known with certainty only from Savaii and Tutuila, at elevations of 500–600 m. (Tutuila) to 1500–1700 m. (Savaii). Except for the type, the only available material is that collected and cited by Christophersen, who records the plant as a shrub or tree 2–4 m. high, with white flowers and green fruit, growing in wet scrub-forest or in high elevation rain-forest.

SAMOA: SAVAII: Tuisivi Range, above Safotu-Letui, *Christophersen 784* (Bish, NY), *812* (Bish, K, NY, UC, US); above Matavanu Crater, *Christophersen & Hume 2257* (Bish, NY). TUTUILA: Matafao Ridge, *Christophersen 1052* (Bish), *1066* (Bish); top of Le Pioa, *Christophersen 3532* (Bish, NY, UC), *3556* (Bish, K). Samoa, without definite locality: *U. S. Expl. Exped.* (GH, NY, US 15295 TYPE).

Among the Samoan *Acronychiae, A. richii* seems to be the most distinct entity, although its differentiating characters are perhaps merely those pertaining to a reduction in size of certain parts. In flowers, the species is essentially similar to the others in Samoa, with the exception that its petals, filaments, and anther-connectives are possibly more copiously glandular-punctate than usual. The very reduced and few-flowered inflor-

escences and the short-petiolate, comparatively small, unifoliolate leaves permit recognition of the species. Christophersen points out minor foliage differences between the material from Savaii and Tutuila.

3. **Acronychia retusa** A. Gray, Bot. U. S. Expl. Exped. 1: 338. *pl. 34, A.* 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 416. 1857; Lauterb. in Bot. Jahrb. 41: 228. 1908; Christophersen in Bishop Mus. Bull. 128: 108. 1935.

Melicope vaupelii Lauterb. in Bot. Jahrb. **41:** 227. 1908; Rechinger in Denkschr. Akad. Wiss. Wien **85:** 294. 1910.

DISTRIBUTION: Samoa, known with certainty only from Savaii and Upolu, where it occurs in coastal thickets or forests. It has been recorded as a shrub, up to 3 m. high, with green fruits.

SAMOA: SAVAII: Coastal regions, *Vaupel 67* (type coll. of *Melicope vaupelii*, Bish, K, US); back of Safotu (Safune), in coconut plantation, *Christophersen & Hume 2437* (Bish, US); Sataua-Papa, *Christophersen & Hume 3414* (Bish, K, NY, UC). UPOLU: Near Leulumoenga, *Rechinger 173* (US). Samoa, without definite locality: *U. S. Expl. Exped.* (GH, NY, US 15294 TYPE), *Powell* (K), *Whitmee* (K). Rechinger cites material from Savaii and Upolu which I have not seen.

Acronychia retusa may be readily distinguished from *A. richii* by its comparatively large (also unifoliolate) leaves, of which the apices are rounded and usually obviously retuse. The texture of its leaflet-blades is somewhat thinner than that of *A. richii,* its inflorescences are more ample, and the glands of both foliage and flowers are less obvious. It is to be noted that *A. retusa* is a coastal plant, while *A. richii* is known only from inland forests near the highest elevations of the islands where it occurs. Direct comparison of the type collections of the two binomials concerned leaves no doubt of the correctness of the reduction of *Melicope vaupelli,* as proposed by Christophersen.

4. **Acronychia niueana** St. John in Bishop Mus. Bull. 178: 67. *fig. 3.* 1943.

DISTRIBUTION: Tonga (Tongatabu Island) and Niue, at low elevations, occurring as a tree or shrub 2–5 m. high in thickets or on the edges of forest. The petals are said to be white or greenish white, and the fruit is green. On Niue Yuncker records the local names *kalakalalai, kalapalai,* and *kalakalai,* noting that the leaves are used in native medicine to treat skin irritations. A local name of *palagi* was noted on Tongatabu. Three collections, *Yuncker 9917, 9637,* and *9753,* were originally cited by St. John as gynetype (first two) and androtype (third); Prof. Yuncker has kindly loaned me his specimens of this species.

TONGA: TONGATABU: *Setchell & Parks 15184* (UC); near Fanogahina, *Setchell & Parks 15466* (Bish, K, UC).

NIUE: Southwest of Lakepa village, *Yuncker 9917* (DP COTYPE COLL.); south of Liku village, *Yuncker 9753* (DP COTYPE COLL.); east of Alofi, *Yuncker 9637* (DP COTYPE), *9777* (DP, US), *10083* (DP, US).

As pointed out by St. John, the alliance of the only *Acronychia* known from Niue (to which the Tongatabu specimens here cited may safely be

referred) is with *A. retusa*. In the original publication a number of characters differentiating the two species are elaborated, but it appears to me that the only ones of significance refer to the indument of the disk (although this is too minute a feature to be very useful) and filaments, the length of fruiting pedicels, and the size of the mature capsules and seeds. In general, *A. niueana* has leaflet-blades larger and with more numerous secondaries, on the average, than those of *A. retusa*.

5. **Acronychia boweriana** Christophersen in Bishop Mus. Bull. **128:** 106. *fig. 13*. 1935.

DISTRIBUTION: Samoa; the only specimens thus far known are from Savaii at elevations of 1000–1500 m., where Christophersen found the plant locally common. It is a tree, or occasionally a shrub, 2–8 m. high, growing in wet forest or in open scrub-forest; the flowers are white.

SAMOA: SAVAII: Above Matavanu Crater, *Christophersen & Hume 2016* (Bish, K, NY, UC, US), *2152* (Bish TYPE, K, NY, UC, US); above Salailua, *Christophersen 2666* (Bish, K, US), *2668* (Bish, NY, UC, US), *3082* (Bish, K, NY, UC, US), *3085* (Bish, K, NY, UC, US); Aopo-Ngangamalae, *Christophersen 3451* (Bish, NY).

Christophersen refers his species to the alliance of *A. albiflora* Rechinger, stating that it differs "in its larger and narrower leaves, style shorter than ovary, ovary puberulous." These characters do not seem very adequate in this species-complex, where length of style and abundance of ovary-indument are flexible. However, I am inclined to agree with Christophersen in maintaining *A. boweriana* as distinct from Rechinger's species. The type of *A. albiflora*, which neither Christophersen nor I has examined, was collected near Lanutoo, Upolu, whereas *A. boweriana* appears to be strictly limited to high elevations on Savaii.

The only concrete character that I have found dependable in considering the unifoliolate Samoan *Acronychiae* with large and distally narrowed (rather than rounded) leaflet-blades lies in the articulation of the petiole with the single leaflet. In *A. boweriana* the leaflet is essentially sessile upon the articulation, while the contrasting form has the leaflet obviously petiolulate. Specimens of the latter group are found on all three of the large Samoan islands; the usual condition of the leaves here would appear to be trifoliolate. Disappearance of the lateral leaflets results in a unifoliolate condition in which the remaining leaflet is still conspicuously petiolulate. In describing *A. albiflora* Rechinger did not mention this character, but the fact that his type came from Upolu lands weight to a supposition that his species is not the same as *A. boweriana*.

6. **Acronychia albiflora** Rechinger in Denkschr. Akad. Wiss. Wien **85:** 294. 1910.

Melicope tahitensis var. *glabra* Lauterb. in Bot. Jahrb. **41:** 227. 1908.
Acronychia sp. Christophersen in Bishop Mus. Bull. **128:** 109, 110. 1935.

DISTRIBUTION: Samoa, known only from Savaii and Upolu, at elevations of 550–1500 m. The species is reported as a small tree or shrub 3–7 m. high, occurring in wet or low forest or on forest-edges; the flowers are

white and the fruit green. Local names recorded by Christophersen are *matalafi* (on Savaii) and *alo alo* or *fua nini'i* (on Upolu). The type is *Rechinger 147*, collected near Lanutoo, Upolu.

SAMOA: SAVAII: Maugaloa, *Vaupel 343* (type coll. of *Melicope tahitensis* var. *glabra*, K, US); above Matavanu Crater, *Christophersen 837* (Bish, K, NY), *Christophersen & Hume 1988* (Bish, K), *2091* (Bish), *2162* (Bish, UC, US), *2172* (Bish, NY), *?2175* (small-leaved form, Bish, NY, UC); above Salailua, *Christophersen 2673* (Bish, K, NY, US); rim of Papafu Crater, *Christophersen 2724* (Bish). UPOLU: Near Malololelei, *Christophersen 329* (Bish, K); Lanutoo, *Christophersen 392* (Bish, NY, UC). Samoa, without definite locality: *Whitmee 29* (or *79?*) (K).

The material here referred to *A. albiflora* is diverse in size of leaflets, but fairly consistent as to leaf-texture, shape, and venation. Floral characters scarcely serve to distinguish species in the complex involving this entity, *A. boweriana*, and *A. heterophylla*. The only available collection from the type locality of *A. albiflora* (Lanutoo, Upolu) is *Christophersen 392*, which has trifoliolate leaves, with leaflets somewhat larger than those described by Rechinger. However, it is seen here and elsewhere (e. g. in *A. heterophylla*) that unifoliolate and trifoliolate leaves occur on the same plant; in other plants one or the other type of leaf is predominant, sometimes exclusively so. The type of *A. albiflora* is described as having entire (i. e. unifoliolate?) leaves; the original description seems to apply very well to the type collection of *Melicope tahitensis* var. *glabra*, from Maugaloa, Savaii (*Vaupel 343*, cited above). *Vaupel 343* has predominantly unifoliolate leaves, but occasional trifoliolate leaves are also present on the specimens.

The closest relationship of *A. albiflora*, if my identification is correct, is with *A. heterophylla*. Although the extreme forms of these two species seem quite different, an analysis of the available material indicates that only generalizations concerning the leaflet-shape and direction of the nerves differentiate them.

7. **Acronychia heterophylla** A. Gray, Bot. U. S. Expl. Exped. 1: 333. *pl. 32*. 1854; C. Muell. in Walp. Ann. Bot. Syst. 4: 416. 1857; Lauterb. in Bot. Jahrb. 41: 228. 1908; Setchell in Carnegie Inst. Publ. 341: 88. 1924; Christophersen in Bishop Mus. Bull. 128: 108. 1935.

Acronychia diversifolia A. Gray, Bot. U. S. Expl. Exped. 1: 334. 1854, sphalm.

Evodia vatiana Setchell in Carnegie Inst. Publ. 341: 87. *pl. 4, fig. E*. 1924.

DISTRIBUTION: Samoa, known with certainty only from Tutuila, where it occurs in forest at 100–400 m. as a tree or shrub 3–10 m. high. Recorded local names are *matamo* (by Setchell), *usi vao* (by Garber), and *fua feti'i* (by Christophersen).

SAMOA: TUTUILA: *U. S. Expl. Exped.* (GH, NY, US 15289 and 15290 TYPE); above Vatia, *Setchell 329* (UC type of *Evodia vatiana*); vicinity of Pago Pago, *Sütupe* (in *Setchell*) *429* (UC), *Wilder 34* (Bish),

Garber 909 (Bish, K, NY); Alava ridge, *Christophersen 1137* (Bish, NY, UC); along Aua-Afono trail, *Yuncker 9426* (Bish, DP). Samoa, without definite locality: *Powell 234* (K), *286* (K).

Specimens referable to this entity have predominantly trifoliolate leaves, although unifoliolate leaves are of common occurrence, even in type material, as noted by Gray. So far as is known with certainty, this species is limited to Tutuila, while the closely related *A. albiflora* has been collected only on Savaii and Upolu. The foliage characters which separate these two entities, as indicated in my key, are not pronounced, but they seem adequate. In addition, the leaflet-blades of *A. heterophylla* seem somewhat thinner in texture and duller, with more obvious secondaries, as contrasted with those of *A. albiflora*.

The type specimen of *Evodia vatiana,* cited above, has been carefully examined; it is a staminate specimen with extremely small and immature flowers. Although the original description states, "staminibus 4," dissections of several flowers have established that the stamens are always 8, alternately unequal; the undeveloped sterile ovary is seen to be 4-sulcate but apparently not deeply lobed. These characters indicate that the species represents *Acronychia,* and close comparison with the type of *A. heterophylla* fails to disclose differences of consequence. In inflorescence-indument, leaflet-texture, etc., the two types are indistinguishable. The type of *Evodia vatiana* has the leaflets obtuse to rounded and lightly emarginate at apex, whereas in the Exploring Expedition material they are often short-acuminate (but sometimes merely obtuse), the actual apex also being emarginate to a greater or lesser degree. Among the material cited there is considerable variation in leaflet-apex, and the type of *Evodia vatiana* can be precisely matched in this character by some of the leaflets of *Garber 909* and *Wilder 34*.

4. MELICOPE J. R. & G. Forst.

In Samoa, two entities have thus far been accredited to *Melicope*, but neither of them actually belongs to that genus, *M. vaupelii* Lauterb. being a synonym of *Acronychia retusa*, and *M. tahitensis* var. *glabra* Lauterb. being referable to *Acronychia albiflora*. However, it appears that there is a Samoan plant which should be placed in *Melicope;* this is *Pelea lucida* A. Gray, for which I here propose a new combination.

Melicope has not yet been mentioned in the literature as occurring in Fiji, but in current collections I find four entities in the genus which appear to merit specific recognition. Individuals of *Melicope* are very scarce in Fiji, extraordinarily so in Samoa (from which only a single collection is known), and apparently lacking in Tonga. Without very careful examination, the specimens of this genus can readily be mistaken for *Evodia* or *Acronychia*. In our region, *Melicope* is now known from five species, four of which are here described as new. Floral differences among the species are very slight, but each has well marked vegetative characteristics.

KEY TO THE SPECIES

Leaves 1-foliolate, the leaflet-blades ovate-oblong, 8–10 cm. long, 3.5–5 cm. broad, acuminate or cuspidate (actual apex obtuse), with numerous (12–20 per side) spreading and sharply prominulous secondary nerves; Samoa.....1. *M. lucida.*

Leaves 3-foliolate (very rarely 1-foliolate in no. 3), the leaflet-blades usually more than 10 cm. long, with fewer than 12 secondary nerves per side (except in no. 5, with very large leaves); Fijian species.

Leaflets comparatively small, the blades 8–17 × 2–8.5 cm., glabrous or sparsely puberulent on nerves beneath, the secondary nerves 6–12 per side; petioles rarely exceeding 10 cm. in length.

Leaflet-blades cuspidate or acuminate at apex, not conspicuously decurrent at base on petiolules, these 2–13 mm. long; pedicels 1.5–3.5 mm. long at anthesis.

Leaflet-blades elliptic or elliptic-obovate, 9.5–17 cm. long, 4.5–8.5 cm. broad, cuspidate to an apex 3–10 mm. long, the secondary nerves 8–12 per side; petioles usually 5–10.5 cm. long.....2. *M. homocophylla.*

Leaflet-blades lanceolate or oblanceolate, usually 8–12.5 cm. long and 2–4 cm. broad, gradually acuminate to an apex 10–20 mm. long, the secondary nerves 6–10 per side; petioles usually 4–6 cm. long.....3. *M. taveuniensis.*

Leaflet-blades rounded and abruptly callose-mucronate at apex (mucro 1–2 mm. long), long-decurrent at base on petiolules 5–20 mm. long, these appearing narrowly winged; pedicels 1–2 mm. long at anthesis.....4. *M. flaviflora.*

Leaflets large, the blades 20–40 × 10–16 cm., copiously hispidulous-puberulent beneath at least on nerves, the secondary nerves 12–17 per side; petioles 12–23 cm. long.....5. *M. robusta.*

1. **Melicope lucida** (A. Gray) comb. nov.

Pelea ? lucida A. Gray, Bot. U. S. Expl. Exped. **1:** 348. *pl. 34, B.* 1854.
Evodia ? lucida Drake, Ill. Fl. Ins. Mar. Pacif. 134. 1890, non Miq. (1867).

DISTRIBUTION: Known only from the type specimen, collected on Tutuila, Samoa; no habitat or altitudinal data are available.

SAMOA: TUTUILA: *U. S. Expl. Exped.* (US 15034 TYPE).

This rare species, known only from the type collection, was referred to *Pelea* with doubt by Gray, who remarked: "Apparently it differs from *Melicope* only in the valvate aestivation of the corolla and the deciduous calyx, and from *Acronychia* in the uncombined ovaries. Since it is nearly in these same particulars that *Pelea* is distinguished from these two genera, the plant may most naturally be referred to the present genus, with which it pretty well accords in habit." The value of valvate as opposed to imbricate petals, in this group of genera, seems doubtful, since in other species of *Melicope,* unquestionably related to each other, the petals may be either valvate or barely imbricate or obviously imbricate. In his description of *Melicope,* Engler (in Nat. Pfl. ed. 2. **19a:** 231. 1931) states, "Petals . . . imbricate or with inflexed valvate apices." *Pelea lucida* is

not listed by Engler (op. cit. 235) in his discussion of that genus, in which he includes only the various Hawaiian species and one questionable entity from Madagascar.

It appears to me that the Samoan species of *Pelea* falls into a reasonable concept of *Melicope* as defined by Engler. A final evaluation of generic lines in this part of the Rutaceae seems to be still in the future, but if reduction in the number of genera is the ultimate solution, *Pelea* A. Gray (1854) cannot compete for priority with *Melicope*, *Acronychia*, and *Evodia* (1776, all proposed by J. R. and G. Forster).

2. **Melicope homoeophylla** sp. nov.

Acronychia heterophylla sensu A. C. Sm. in Bishop Mus. Bull. **141**: 75. 1936, non A. Gray.

Arbor dioica 5–10 m. alta, partibus novellis copiose puberulis, ramulis primo quadrangularibus minute pallido-puberulis mox subteretibus glabratisque; foliis oppositis trifoliolatis, petiolis leviter canaliculatis (4–)5–10.5 cm. longis ut ramulis puberulis et glabratis, petiolulis paullo canaliculatis terminalibus 5–13 mm. lateralibus 2–7 mm. longis; foliolorum laminis papyraceis in sicco supra fuscis subtus paullo pallidioribus, terminalibus elliptico-obovatis, lateralibus inaequilateraliter ellipticis plerumque subminoribus, 9.5–17 cm. longis, 4.5–8.5 cm. latis, basi obtusis vel acutis et in petiolulum decurrentibus, superne in apicem acutum 3–10 mm. longum cuspidatis, obscure immerso-glanduloso-punctatis, supra praeter costam basi plus minusve puberulam glabris, subtus costa parce puberulis mox glabratis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 8–12 patentibus marginem versus anastomosantibus supra planis subtus elevatis, rete venularum supra plano subtus prominulo; inflorescentiis apices ramulorum versus axillaribus late paniculatis multifloris sub anthesi 4–8 cm. longis latisque, pedunculo gracili 1–3 cm. longo, ramulis patentibus minute puberulis glabratisque, bracteis bracteolisque minutis; pedicellis teretibus sub anthesi ♂ 3–3.5 mm. ♀ 1.5–2 mm. longis minutissime puberulis (pilis haud 0.05 mm. longis); calyce tenuiter carnoso rotato sub anthesi 2–2.5 mm. diametro eglanduloso extus puberulo 4-lobato, lobis ovato-deltoideis 0.7–1 mm. longis 0.8–1.2 mm. latis subacutis; petalis 4 aestivatione valvatis subcarnosis obscure glandulosis extus parce puberulis mox glabratis, sub anthesi oblongis vel oblongo-deltoideis, 2.7–3.2 mm. longis, 1.3–2 mm. latis, apice subacutis minute cucullatis; staminibus 8 leviter inaequalibus, filamentis membranaceis ligulatis superne angustatis glabris in floribus ♂ 2.3–2.8 mm. longis (in floribus ♀ circiter 1.3 mm. et 0.8 mm. longis), antheris ellipsoideis in floribus ♂ 0.6–0.7 mm. longis (in floribus ♀ minoribus et sterilibus); disco in floribus ♂ carnoso pulvinato-oblato obscure 8-lobato 0.6–0.7 mm. alto circiter 2 mm. diametro pilis haud 0.05 mm. longis copiose hispidulo-puberulo, ovarii vestigio in disco immerso puberulo lobis cum ovulis 2 abortis, styli vestigio 0.2 mm. longo glabro, stigmate obscure 4-lobato; disco in floribus ♀ pulvinato obscure 8-lobato 0.4–0.5 mm. alto 1.6–1.7 mm. diametro stipitiformi ut ♂ copiose puberulo; carpellis 4 liberis,

faciebus interioribus glabris adpressis exterioribus minute hispidulo-puberulis, ovulis 2 superpositis, stylis in columnam crassam circiter 0.8 mm. longam parce puberulam connatis, stigmate capitato obscure 4-lobato 0.5–0.6 mm. diametro.

FIJI: VANUA LEVU: Thakaundrove-Mathuata boundary: Crest of Korotini Range, between Navitho Pass and Mt. Ndelaikoro, alt. 650–900 m., Nov. 21, 1933, *Smith 539* (Bish, GH, K, NY, UC, US 1676627 TYPE) (*ndrautolu;* tree 5 m. high, in dense forest); Thakaundrove: Southwestern slope of Mt. Mbatini, alt. 300–700 m., *Smith 632* (Bish, GH, K, NY, UC, US) (*nggarikalavu;* tree 10 m. high, in dense forest; petals and filaments white).

Since the more important generic characters occur in the pistillate flowers, no. 539 has been designated as the type; no. 632 bears staminate flowers. The two collections are quite identical in foliage, indument, perianth, etc. Another specimen which very probably belongs here is *Gillespie 3130* (Bish, UC) (Viti Levu: Namosi: Summit of Mt. Naitarandamu, alt. 1250 m.), with young pistillate flowers. This differs from the Vanua Levu material in having a more pronounced and persistent indument on leaves, inflorescences, and pedicels, but it almost certainly represents *Melicope* and very likely the new species.

The new species bears a superficial resemblance to the Samoan *Acronychia heterophylla* A. Gray, from which, of course, its free carpels distinguish it. The *Melicope* further differs in the much closer indument of its disk, the less obvious glands of its filaments, and other minor floral characters.

3. **Melicope taveuniensis** sp. nov.

Frutex ad 4 m. altus forsan polygamo-dioicus, partibus novellis copiose pallido-puberulis, ramulis gracilibus superne quadrangularibus et minute puberulis mox subteretibus glabratisque; foliis oppositis 3-foliolatis raro 1-foliolatis, petiolis gracilibus supra complanatis (2–)4–6 cm. longis ut petiolulis mox glabratis, petiolulis leviter canaliculatis subaequalibus 2–6 mm. longis; foliolorum laminis in sicco viridi-fuscis papyraceis lanceolatis (vel terminalibus oblanceolatis et paullo majoribus), (6–)8–12.5 cm. longis, (1.5–)2–4 cm. latis, basi acutis et in petiolulum decurrentibus, apice in acuminem 1–2 cm. longum gradatim angustatis, inconspicue immerso-glanduloso-punctatis, utrinque glabris vel subtus costa minute puberulis, costa supra subplana subtus prominente, nervis secundariis utrinsecus 6–10 erecto-patentibus marginem versus anastomosantibus supra planis subtus elevatis, rete venularum utrinque prominulo vel supra plano; inflorescentiis apices ramulorum versus axillaribus paniculatis pauciramosis paucifloris, sub anthesi et fructu juvenili 3–4 cm. longis, pedunculo gracili ad 1.5 cm. longo, ramulis pedicellisque gracilibus minute et parce puberulis (pilis haud 0.05 mm. longis); pedicellis sub anthesi 2–3 mm. longis; calyce tenuiter carnoso cupuliformi-rotato circiter 1.5 mm. diametro extus parce puberulo 4-lobato, lobis oblongo-deltoideis circiter 0.5 mm. longis subacutis; petalis 4 aestivatione videtur anguste imbricatis subcarnosis ovatis

circiter 1.3 × 1 mm. (ante anthesin) subacutis et minute cucullatis, glabris vel extus parce puberulis; florum videtur ♂ vel forsan ☿ staminibus 8 inaequalibus, filamentis subcarnosis ligulatis glabris alternatim circiter 0.5 mm. et 0.3 mm. (immaturis), antheris ellipsoideis 0.4–0.6 mm. longis abundanter fertilibus apice rotundatis; disco pulvinato minute ut ovariis puberulo; carpellis 4 liberis, faciebus exterioribus copiose minute puberulis, stylo minuto, stigmate 4-lobato, ovulis ante anthesin haud visibilibus; calyce sub fructu juvenili haud accrescente, staminibus persistentibus, filamentis longioribus ad 1.2 mm. longis, carpellis divergentibus persistenter puberulis nonnullis abortis.

FIJI: TAVEUNI: Western slope, between Somosomo and Wairiki, alt. 700–900 m., Dec. 14, 1933, *Smith 754* (Bish, GH, K, NY TYPE, UC, US) (shrub 4 m. high, in forest; flower-buds white).

Although mature flowers are not available, the advanced buds and the young fruits (with persistent perianth and stamens) show that the stamens are 8 and the carpels free, a combination of characters indicating *Melicope*. The available flowers have fertile anthers and also a well developed gynaecium, but whether or not the ovaries are fertile cannot be stated. The few available young fruits are attached to different branches, and so it is possible that I obtained material from two adjacent plants; it is more likely, however, that the flowers are perfect, since as a rule the staminate flowers of *Melicope* do not have so well formed a gynaecium.

Melicope taveuniensis is obviously a close relative of the preceding species, *M. homoeophylla*, which it resembles in fundamental characters and in leaf-texture, indument, etc. It differs primarily in its much narrower and gradually acuminate leaflet-blades and in the few other foliage characters mentioned in my key.

4. **Melicope flaviflora** sp. nov.

Frutex dioicus gracilis 2–3 m. altus, partibus novellis copiose tomentello-puberulis, ramulis juvenilibus subcomplanatis ad nodos incrassatis parce stellato-puberulis mox subteretibus glabratisque; foliis oppositis trifoliolatis, petiolis rectis supra complanatis 5–8 cm. longis et petiolulis ut ramulis puberulis glabrescentibus, petiolulis leviter canaliculatis fere ad basim anguste alatis terminalibus 10–20 mm. lateralibus 5–10 mm. longis; foliolorum laminis subcoriaceis siccitate viridi-fuscis subtus pallidioribus, obovatis vel obovato-ellipticis (lateralibus valde inaequilateralibus), 8–12.5 cm. longis, 3–5.5 cm. latis, basi attenuatis et in petiolulum longe decurrentibus, apice rotundatis et abrupte calloso-mucronatis (mucrone 1–2 mm. longo), margine anguste recurvatis, inconspicue immerso-glanduloso-punctatis, utrinque praecipue costa nervisque parce stellato-puberulis mox glabratis, costa valida supra subplana subtus prominente, nervis secundariis utrinsecus 9–12 patentibus anastomosantibus supra planis subtus elevatis, rete venularum supra immerso subtus prominulo; inflorescentiis ♀ solis visis axillaribus paniculatis multifloris sub anthesi 5–10 cm. longis 2–5 cm. latis, pedunculo (2–5 cm. longo) et ramulis

gracilibus parce stellato-puberulis, ramulis paucis patentibus, bracteis sub ramulis primariis oblongis 1–3 mm. longis, bracteis aliis bracteolisque minutis deciduis; pedicellis sub anthesi 1–2 mm. longis minute puberulis (pilis haud 0.05 mm. longis); calyce submembranaceo cupuliformi 2.3–2.5 mm. diametro extus obscure puberulo fere ad basim 4-lobato, lobis ovatis 0.8–1 mm. longis 1.3–1.5 mm. latis obtusis; petalis 4 aestivatione anguste imbricatis parce pellucido-punctatis elliptico-oblongis, submaturis 2–2.2 × 1.5 mm., apice obtusis et minute cucullatis; staminibus 8 subaequalibus, filamentis carnosis ligulatis glabris 0.4–0.5 mm. longis, antheris sterilibus ellipsoideo-ovoideis obtusis 0.5–0.6 mm. longis; disco pulvinato stipitiformi 0.2–0.3 mm. alto circiter 1.3 mm. diametro minute puberulo; carpellis 4 liberis, faciebus interioribus glabris adpressis exterioribus ut disco puberulis, ovulis 2 superpositis, stylis liberis in columnam crassam brevem haud 0.2 mm. longam inferne obscure puberulam adpressis, stigmate capitato circiter 0.8 mm. diametro profunde 4-lobato, lobis minute emarginatis.

FIJI: VITI LEVU: Mba: Ridge between Mt. Nanggaranambuluta [Lomalangi] and Mt. Namama, east of Nandarivatu, alt. 1050–1120 m., June 30, 1947, *Smith 4998* (A TYPE, US) (*kai tambua;* slender simple-stemmed shrub 2–3 m. high, in dense forest; petals pale yellow; anthers bright yellow).

Although its floral characters are essentially similar to those of the two preceding species, *M. flaviflora* is sharply characterized by its predominantly obovate leaflet-blades, which are rounded and short-callose-mucronate at apex, with gradually narrowed bases long-decurrent on comparatively long petiolules. The texture of the leaflet-blades is comparatively thick, and the indument of vegetative parts is stellate (hairs with tufted ascending branches) and fairly persistent.

5. **Melicope robusta** sp. nov.

Arbor vel frutex ad 4 m. altus dioicus (vel monoicus?), partibus novellis copiose hispidulis, ramulis robustis apicem versus 6–13 mm. diametro quadrangularibus hispidulo-puberulis demum subteretibus glabratisque; foliis oppositis magnis trifoliolatis, petiolis robustis (4–6 mm. diametro) 12–23 cm. longis basi et apice incrassatis leviter vel profunde canaliculatis persistenter hisidulo-puberulis (pilis 0.2–0.4 mm. longis); foliolis subsessilibus, petiolulis ut petiolis hispidulis terminalibus ad 3 mm. longis lateralibus subnullis; foliolorum laminis subcoriaceis in sicco fusco-viridibus, obovatis vel elliptico-obovatis (lateralibus inaequilateralibus), 20–40 cm. longis, 10–16 cm. latis, basi (terminalibus) attenuatis et in petiolulum decurrentibus vel (lateralibus) late obtusis margine inferiore rotundatis, apice in acuminem gracilem 3–10 mm. longum callosum cuspidatis raro subrotundatis, margine saepe anguste recurvatis, inconspicue immerso-glanduloso-punctatis, supra praeter costam et nervos saepe puberulos mox glabratis, subtus stellato-hispidulo-puberulis (pilis albidis 0.2–0.8 mm. longis, costa nervisque persistentibus, facie demum deciduis),

costa valida supra leviter sulcata et complanata subtus valde prominente, nervis secundariis utrinsecus 12–17 irregulariter patentibus marginem versus conspicue anastomosantibus supra subplanis subtus prominentibus rete venularum supra immerso subtus prominulo copiose interconnexis; inflorescentiis late paniculatis multifloris sub anthesi ad 14 cm. longis et 10 cm. latis, pedunculo (ad 8 cm. longo) ramulisque robustis subcomplanatis copiose hispidulo-puberulis (pilis 0.2–0.4 mm. longis), bracteis sub ramulis primariis oblongis circiter 1.5 mm. longis, bracteis aliis bracteolisque minutis deciduis; pedicellis gracilibus sub anthesi et fructu 1–2 mm. longis decidue puberulis; calyce subrotato 1.5–2 mm. diametro obscure immerso-glanduloso ut pedicellis puberulo, lobis 4 ovato-deltoideis 0.5–1 mm. longis 0.7–1.2 mm. latis subacutis; petalis 4 aestivatione manifeste anguste imbricatis submembranaceis conspicue glanduloso-punctatis oblongis, 1.8–2.3 mm. longis, 1–1.3 mm. latis, utrinque glabris, apice subacutis et minute cucullatis; staminibus 8 alternatim inaequalibus, filamentis membranaceis glabris ligulatis superne angustatis in floribus ♂ circiter 1.5 mm. et 1 mm. longis (in floribus ♀ 0.3–0.6 mm. longis), antheris ellipsoideis vel subdeltoideis dorso obscure glanduloso-lineolatis 0.4–0.5 mm. longis (in floribus ♂ fertilibus, in ♀ similibus sed sterilibus); disco in floribus ♂ pulvinato circiter 0.3 mm. alto et 1 mm. diametro pilis haud 0.1 mm. longis copiose velutino-puberulo, ovario (videtur sterili) profunde 4-lobato ut disco piloso, styli vestigio circiter 0.2 mm. longo; disco in floribus ♀ subsimili, carpellis 4 liberis sed adpressis ubique velutino-puberulis, ovulis 2 superpositis, stylis in columnam circiter 0.8 mm. longam connatis vel basim versus liberis, stigmate peltato-capitato 0.4–0.5 mm. diametro 4-lobato; inflorescentiis sub fructu amplis ad 22 cm. longis latisque, perianthio staminibusque longe persistentibus, carpellis submaturis complanato-ellipsoideis ad 6 mm. longis et 5 mm. latis (nonnullis saepe abortis), angulo interiore acutis, apice rotundatis, persistenter puberulis, seminibus 2 oblique superpositis maturis non visis.

FIJI: VITI LEVU: Mba: Hills between Nggaliwana and Tumbeindreketi Creeks, east of the sawmill at Navai, alt. 725–800 m., Sept. 2, 1947, *Smith 5863* (A TYPE, US) (*sauwangga*; slender tree 3–4 m. high, in dense forest; fruit green); Naitasiri: Tamavua woods, alt. 150 m., *Gillespie 2417* (Bish, UC); Naitasiri or Rewa: Central Road, Suva district, *Tothill 214* (K); Rewa: Upper Veisari River, on trail to Nambukaluka [on Waindina River], *Horne 975* (GH, K).

DISTRIBUTION: As shown by the cited specimens, this apparently rare species is thus far known only from the forested portion of Viti Levu, at elevations from near sea-level up to 800 m. The specimen indicated as the type, of which numerous duplicates are available, bears nearly mature fruits with persistent floral remnants. The only collection with developed flowers, *Horne 975*, has either staminate (Gray Herbarium sheet) or pistillate (Kew sheet) inflorescences. It cannot be stated whether these specimens are from the same individual or from different plants, and therefore the dioecious or monoecious nature of the species remains in doubt.

Melicope robusta is one of the most easily recognized species of the

family in Fiji, characterized by its very large leaves, stout branchlets, persistent indument, etc. In leaf-texture and -shape it is suggestive of the preceding, *M. flaviflora,* but dimensional differences are striking.

Department of Botany,
U. S. National Museum,
Smithsonian Institution.

STUDIES IN THE THEACEAE, XXIII
THE GENUS PELLICIERA

CLARENCE E. KOBUSKI

THE MONOTYPIC GENUS *Pelliciera* was first described in Bentham & Hooker, Gen. Pl. 1: 186. 1862, from manuscript prepared by Planchon & Triana. Later the same year, in Ann. Sci. Nat. sér. 4, 17: 380. 1862, the genus was treated by Triana & Planchon under the name "*Pelliceria*." The species *Pelliciera rhizophorae* was here introduced — also under the misspelled generic name. This error in spelling was undoubtedly a *lapsus calami,* since the genus was dedicated by Triana & Planchon to "Guillaume Pellicier évêque de Montpellier, diplomat, érudit, naturaliste, qui fut le Mécène et presque le collaborateur du célèbre Rondelet."

When originally described in Bentham & Hooker, the genus was associated with the tribe Gordonieae. In 1873, Baillon created a separate series, Pelliciereae [Pellicerieae] for the genus. Szyszylowicz, in his treatment of the family for Nat. Pflanzenfam. (1893), followed Baillon's lead in placing the genus in a separate category as "V. Pelliciereae." More than thirty years later Melchior, in the second edition (1925), designated the tribe Pelliciereae.

Most taxonomists, taking into consideration the unusual habitat of the genus, have accepted it as belonging to the family Theaceae. However, this acceptance of the position of *Pelliciera* is not universal among botanists. Recent anatomists, Record (1942) and Metcalfe & Chalk (1950), suggest that *Pelliciera* should be put into a separate family. Record treated only the American genera and based his findings on the anatomy of the wood. He excluded *Pelliciera* from the Theaceae, but included *Archytaea* and *Bonnetia,* two very closely allied American genera. Metcalfe & Chalk, treating all the genera, excluded both *Pelliciera* and *Bonnetia,* designating a separate family for each genus, and included *Archytaea* and *Ploiarium*, the latter an Asiatic genus and closely related to *Archytaea.* Beauvisage (1920), cited in the literature of this family by Metcalfe & Chalk, originated the idea of separating *Pelliciera* from the Theaceae and established the family Pelliciéracées. In the course of this study I had an opportunity to discuss the problem with Prof. I. W. Bailey of our staff and was shown slides of various anatomical specimens within the family. I was impressed by the differences exhibited in the slides upon which the anatomical conclusions have been based and hasten to admit that these evidences must be taken into consideration in the future and may result in the very separation that the anatomists suggest.

Record offered no summary of his findings. He stated only that his anatomical description of the family "applies particularly to the American genera and includes all of them but *Patascoya* (not available) and

Pelliciera (described separately)." No further statement was made concerning the ultimate disposition of *Pelliciera,* which he included in the descriptions of the genera and in his prepared key to the genera. In the key it is interesting to note that *Pelliciera* was grouped and separated with *Archytaea* and *Bonnetia.*

Metcalfe & Chalk based their separation of *Pelliciera* from other members of the Theaceae primarily on (1) the presence of raphides in the parenchymatous tissue, (2) the decurrent leaf-base, and (3) the almost annular structure of the vascular strand of the petiole. They suggest that the family Pellicieraceae be placed between the Marcgraviaceae and the Theaceae. The Marcgraviaceae possess raphides.

However, one should consider here the degree of separation suggested. Metcalfe & Chalk do not advocate a removal far from the Theaceae. In fact, they suggest that the proposed new family should be placed between the Theaceae and the Marcgraviaceae. This suggestion differs very little from that of the taxonomists Baillon, Szyszylowicz, and Melchior. All these have separated *Pelliciera* from the rest of the Theaceae, each designating a separate category — practically in the same position as that suggested by the anatomist — only without the dignity of possessing a family name.

In regard to the decurrent leaf-base Metcalfe & Chalk stated that it was "unlike most of the true Theaceae." From my experience in the family it seems that the decurrent leaf-base is quite characteristic of most genera in the family, perhaps not always to the marked degree found in *Pelliciera.* In *Bonnetia, Archytaea,* and *Ploiarium* the base of the leaf is of the same type as that found in *Pelliciera.* Metcalfe & Chalk separate *Bonnetia* into a separate family, Bonnetiaceae, but they include *Archytaea* and *Ploiarium* in the Theaceae. In other genera the decurrent leaf-base is often present but not as pronounced as in the three mentioned above. Offhand I might mention *Adinandra, Camellia, Eurya, Gordonia, Ternstroemia,* and *Tutcheria* — to name a few genera from the various tribes of the family — where the decurrent leaf-base is considered not a bit unusual.

In discussing *Bonnetia* Metcalfe & Chalk attribute a completely closed cylindrical vascular strand to the petiole of *B. anceps* Mart. and mention other members of the genus as "exhibiting a median vascular strand which is usually crescent-shaped or almost cylindrical."

Pelliciera Planchon & Triana in Bentham & Hooker, Gen. Pl. 1: 186. 1862. — Triana & Planchon in Ann. Sci. Nat. sér. 4, 17: 380. 1862, as *"Pelliceria."*— Baillon, Hist. Pl. 4: 238. 1873, as *"Pelliceria."*— Hemsley, Biol. Centr.-Amer. 1: 96. 1879.— Szyszylowicz in Nat. Pflanzenfam. III. 6: 192. 1893.— Solereder, Syst. Anat. Dicot. 144–154. 1899.— Beauvisage, Contrib. Etude Anat. Ternstr. 191, 450. 1920.— Melchior in Nat. Pflanzenfam. ed. 2, 21: 154. 1925.— Lemée, Dict. Gen. Phan. 5: 107. 1934.— Record in Trop. Woods 70: 31. 1942.— Metcalfe & Chalk, Anat. Dicot. 1: 204. 1950.

TYPE SPECIES: *Pelliciera rhizophorae* Triana & Planchon.

Flowers hermaphroditic, solitary, axillary, included within two foliaceous involute bracts; sepals 5, imbricate, unequal, free, deciduous; petals 5, free, ligulate, much longer than the sepals; stamens 5, alternate with the petals, the filaments thread-like, closely appressed (but not adnate) within the grooves of the ovary, the anthers long, sagittate, subequal, 2-celled, dehiscing by elongated slits, the connective narrow, projected into a mucro; pistil long-conical, almost equally divided into a ridged ovary and a smooth style, the ovary imperfectly two-celled, occasionally one-celled by abortion, with a single large campylotropous ovule in each cell or with the second ovule lacking, the stigma punctiform. Fruit indehiscent, coriaceous-fungose, napiform in lateral outline, irregularly longitudinally furrowed, one-celled, one-seeded, the seed consisting solely of two large cotyledons, a firm pointed radicle, and a large curved plumule, the endosperm lacking.

Trees in mangrove swamps. Trunk buttressed at base. Leaves glabrous, disposed at the ends of the branches, coriaceous, asymmetrical, sessile, glandular-denticulate along the margin.

For its habitat, *Pelliciera* may be found in the mangrove swamps in association with *Rhizophora*, *Laguncularia*, and *Avicennia*. Its adaptation to such a habitat has brought about a definite specialization generally associated with inhabitants of mangrove swamps. The trunk of the tree flares out at the base in solid flutings as does that of *Taxodium*. From what information I have received the tree is supposed never to develop the aerial or stilt roots common in *Rhizophora*. However, in a photograph in the New York Botanical Garden of a tree isolated by clearing operations in a swamp near Balboa in the Canal Zone of Panama, evidences of stilt roots are also present near the very base. Several of my colleagues have come to the same conclusion that stilt roots are evident when confronted with the photograph. This condition may have been caused by the draining operations.

It has been generally accepted that the habitat and trunk development of *Pelliciera* is exceptional in the family. However, in *Ploiarium alternifolium* (Vahl) Melchior a similar if less extreme condition exists.

This Asiatic species is generally found growing in the sands of beaches, in the secondary jungle, especially in swampy grounds, and occasionally in mossy bogs on mountain tops. Corner (Wayside Trees of Malaya 1: 628. 1940), in recording this species, says, "In very swampy ground numerous slender stilt-roots develop from the trunk, even from a height of 8 ft., and, descending perpendicularly, they surround the trunk like a giant besom." As I mentioned elsewhere in this paper, *Pelliciera* is closely related to *Archytaea* and *Ploiarium*. I have encountered no records of such development, however, in *Archytaea*.

The fruit of *Pelliciera* is far advanced at maturity, ready for almost immediate germination, and possesses the lateral outline of a large leathery top, spongy in texture. It has been reported that the fruit drops

with the point directed toward the mud, in which it lodges ready for almost immediate development. Dr. I. M. Johnston, in his interest in this species, observed the fall of the fruit over a period of time. In his very interesting and enlightening treatment of the species in Sargentia 8: 207. 1949, he states that the fruit always drops with the heavy portion downward. He further states, however, that once in the water the buoyant fruit floats with the beak end downward.

The single seed, when mature, is very simple, and consists of two huge obcordate cotyledons, each measuring as much as 7 cm. across, a pointed radicle which extends into the beak of the fruit, and a curved plumule, often with two or three miniature leaves partially developed. No endosperm is present. The genus *Archytaea* is also distinctive because of the absence of endosperm.

Another character considered by some as at variance with other genera of the Theaceae is the number of stamens. One generally associates with this family a large number of stamens. In *Pelliciera* the number has been reduced to five. This seems a far cry from the multitude found in *Ternstroemia, Gordonia, Stewartia, Archytaea,* and *Ploiarium.* However, some genera in the family do present a low number of stamens. In these genera considerable variation may be found within any given genus, but no species has a number as low as five! A record of some of these is as follows: *Freziera* 15–30; *Adinandra* 15–60; and *Visnea* 10–21.

On the other hand, characters often seemingly of little importance show that a close relationship exists beween *Pelliciera* and other genera of the Theaceae. The leaf-base, as mentioned elsewhere in this paper, is totally decurrent and very much like that found in *Archytaea, Ploiarium,* and *Bonnetia.* In most of the other genera of the family the leaf-base is often decurrent, but in varying degrees. The asymmetrical shape of the leaf, although far from universal, is found among species of several genera. In *Laplacea fruticosa* (Schrader) Kobuski an almost identical pattern of shape and denticulation may be found. In both instances the blade is asymmetrical and glandular denticulations are found along the upper half of the larger side of the leaf. The glandular denticulations in *Pelliciera* are more pustular in character than in *Laplacea,* but, as in all other members of the family when found they slough off or are broken off at maturity.

The long tapering ovary and style ending in a punctate stigma is typical of the family. It is obvious through dissections that reduction in the number of cells has taken place, probably a reduction from five to two cells. Dissections were made of material from both Colombia and Panama. Planchon and Triana recorded in their original manuscript five cells for the ovary (Colombia), based, I feel, solely on the fact that the floral parts were consistently in fives. Bentham and Hooker queried the five-celled ovary and reported it as two-celled. In some of my dissections only a single cell was found in the ovary, abortion of the second cell having already occurred. In other instances the second cell was

present but undeveloped and without an ovule. No ovary with five cells was found!

The ridges on the ovary have been reported as ten in number with the filaments lying in alternate grooves. The number of grooves or ridges is not always ten but close to that number. The filaments which lie pressed within the grooves are not adnate to the ovary but appear so, with the ridges pressing inward and over them during development. The filaments can be drawn from the grooves when the ovary is boiled up. I think I am right in assuming that in fresh material the filaments could likewise be easily separated from the ovary.

The ovary has been reported as pendulous and depicted as attached at the apex. My dissections showed clearly that the ovule is campylotropous, the placenta axial, and the attachment slightly below the apex of the ovule.

The developed seed, although very large, has a buff-colored mealy coating in indefinite quantity. Occasionally this coating may be lacking. This is the typical coating of many seeds in the genus *Ternstroemia*.

Pelliciera rhizophorae Triana & Planchon in Ann. Sci. Nat. sér. 4, **17**: 381. 1862, as "*Pelliceria rhizophorae.*"— Hemsley, Biol. Centr.-Amer. 1: 97, *t. 8*. 1879.— Szyszylowicz in Nat. Pflanzenfam. III. 6: 192, *fig. 96*. 1893.— Pittier, Prim. Fl. Costaricensis **2**: 38. 1898.— Howe in Jour. New York Bot. Gard. **12**: 61–72, *figs. 16–23*. 1911.— Melchior in Nat. Pflanzenfam. ed. 2, **21**: 154, *fig. 67*. 1925.— Standley in Contrib. U. S. Nat. Herb. **27**: (Fl. Panama Canal Zone 267). 1928; in Bot. Ser., Field Mus. Nat. Hist. **18**: (Fl. Costa Rica 702). 1937.— Little in Caribbean Forester 9: 258. 1948.— Johnston in Sargentia 8: 207. 1949.

Pelliceria rhizophorae Triana & Planchon var. *β. Benthamii* Triana & Planchon in Ann. Sci. Nat. sér. 4, **17**: 381. 1862.

Tree 6–15 m. high with a single trunk and elongated crown, buttressed at the base, the bark gray, roughened by conspicuous circular raised light brown lenticels 2–3 mm. in diameter; branches open, the branchlets glabrous, roughened by sharply defined leaf scars and becoming somewhat geniculate near the apex from the large protruding flower scars. Leaves glabrous, usually closely disposed at the ends of the branchlets in a seeming rosette, occasionally along the stem, sessile, coriaceous, 10–15 cm. long, 2–4 cm. wide, asymmetrical, one half appearing constantly as half an ellipse with the widest part near or below the middle, the other half wider with the widest portion usually above the middle, acute at the apex, tapering to a wide decurrent base, the midrib and veins quite inconspicuous, the margin usually entire along the smaller half of the leaf, glandular denticulate along the upper half of the wider side of the leaf when young, later apparently entire. Flowers large, showy, solitary, axillary, although seemingly terminal, sessile; the bud enveloped by two large glabrous foliaceous bracts ca. 5 cm. long and 1 cm. wide, rose-colored, coral-red or crimson; sepals 5, glabrous, imbricate, unequal,

broadly ovate to ovate, 2–2.5 cm. long, ca. 1–1.5 cm. wide, acute at the apex, concave, the median portion thickened by glandular punctations, otherwise membranaceous, the margin entire. Petals 5, free, equal or subequal, lanceolate to ligulate-lanceolate, 5–7 cm. long, ca. 1.5 cm. at the base, 0.4–0.5 cm. near the apex, blunt-pointed, usually white, occasionally pink, hyaline for the most part, thickened in the center, increasingly so in both depth and width toward the base, the margin entire. Stamens 5, 4–5 cm. long, the filaments tenuous, ca. 3.5 mm. long, closely appressed but not adnate within the longitudinal grooves of the ovary for most of their length, the anthers linear, as much as 3 cm. long, sagittate at the base, the narrow connective projected into a point at the apex. Pistil conical cylindrical, 6.5–7 cm. long, divided almost equally into a grooved ovary and a smooth style, the ovary ca. 5 mm. diameter somewhat flattened with the outer surface corrugated into approximately 10 grooves, the filaments resting in alternate grooves, 2-celled with a single large ovule in each cell, occasionally with only one cell ovulated or a single cell by abortion, the style smooth, the stigma punctate, 2-parted. Fruit napiform in lateral outline, coriaceous-fungose, 7–10 cm. long (including the attenuated beak which measures one-third to one-half the entire length), ca. 8 cm. broad and 3–4 cm. thick, reddish brown, irregularly longitudinal-furrowed, with rows of lenticel-like waxy pustules becoming pulverulent. Seed solitary consisting almost wholly of two large fleshy obcordate cotyledons as much as 6 cm. long and 7 cm. across, with a firm pointed radicle projecting into the beak, and a large curved plumule; the endosperm is lacking.

DISTRIBUTION: Mangrove swamps along Pacific coast, and islands of Costa Rica, Panama, Colombia, and Ecuador.

COSTA RICA: Puntarenes: Punta Mala, dans les terrains inondés par la mer, *A. Tonduz 6723* (US), March 1892 (tree).—Daquis Delta, dans les terrains inondés par la mer, *A. Tonduz 6773* (US), March 1892 (tree).—Sandy and muddy beaches, *P. Biolley 2026 H. P.* (US), January 1907.—Sandy beaches, *P. Biolley 17405* (G), January 1909.—Puerto Jiménez de Osa, *A. M. Brenes 696* (Ch), April 14, 1930.—Precise locality lacking, *M. Querós 995* (Ch), October 7, 1941.

PANAMA: Canal Zone: Banks of Rio Grande, growing in mud, *R. E. Woodson, P. H. Allen & R. J. Seibert 762* (AA, Mo, NY), June 21, 1938 (shrubby tree 3–4 m.; calyx red; petals white).—Bella Vista, mangrove swamp, *F. M. Salvoza 1004* (AA), September 10, 1929 (tree 2–3 m.; fruit brownish).—Balboa, on mud of estuary, *M. A. Howe s. n.* (NY), December 18, 1909.—Between Corozal and Ancon, swamp, alt. 10–30 m., *H. Pittier 2644* (G, NY, US), February 2, 1911 (small tree 5 m.; flowers pinkish white). Prov. Panama: Rio La Maestra, mangrove swamps, alt. 0–25 m., *P. H. Allen 32* (AA, Ch, Mo), December 4, 1936 (tree 5 m.; flowers white).—Precise locality lacking, *Bro. Heriberto 210* (US), November 3, 1921. San Jose Island: Perlas Archipelago: Gulf of Panama (ca. 55 miles south-southeast of Balboa): mangrove swamp back of Main Beach, *I. M. Johnston 332* (AA), *1124* (AA), October 30, 1944 and January 12, 1946 (tree 40 ft., the trunk conical at the base; flowers white; fruit husk brown, juicy but firm).

COLOMBIA: Dept. El. Valle: Buenaventura Bay: mangrove thicket along bay, alt. 0–5 m., *E. P. Killip 5222* (AA, NY, US), May 7–9, 1922 (tree 25 ft.; flowers white).—Mangrove swamp, *E. P. Killip 34961* (US), April 13, 1939 (tree 8–10 m.; petals white).—Punta Arenas, north shore of Buenaventura Bay in mangrove swamp, sea level, *E. P. Killip & J. Cuatrecasas 38624* (AA, US), June 2, 1944 (low shrub to tree 10 m.; calyx and petals white).

ECUADOR: Prov. Esmeraldas: Borbón, along Rio Santiago, near La Tola, mangrove swamp at water's edge, *E. L. Little 6423* (US), May 4, 1943 (large tree to 25 m. high and 60 cm. diameter; large 1-seeded pod to 10 cm.).

This water-dispersed species is endemic to the small area of the Pacific coast of Costa Rica, Panama, Colombia, and Ecuador. From the collections studied, it seems that the most varied distribution is found in Panama, where it has been collected in the Canal Zone, Prov. of Panama, and San Jose Island. From Costa Rica six collections were studied, and all were from the beaches of Puntarenes. This appears to be the northernmost limit in the range. In Colombia only three collections were studied. These were from Buenaventura Bay and all three were collected by Killip over a period of twenty-two years. Up until 1943 the abovementioned area comprised the known distribution. In 1943 Little added to the range with his collection *6423* from the Province of Esmeraldas in the extreme northwest of Ecuador, and Johnston made two collections from San Jose Island. In Costa Rica the plant is known by the vernacular name of *mangle piñuela,* in Ecuador as *piñuela,* and in Panama as *palo de sal.*

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

THE GENUS PITTOSPORUM IN THE SINO-INDIAN REGION

With four text-figures

MARI GOWDA

INTRODUCTION

THE GENUS *Pittosporum*, established by Banks on material collected in New Zealand, was published in Gaertner's Fructibus et Seminibus Plantarum 1: 286, *t. 59, fig. 7* (1788). The name is derived from the Greek *pitta*, pitch, and *sporos*, seed, alluding to the sticky pulp enveloping the seeds. In geographic distribution the plant is confined to the Old World, where it is widely spread in the tropics and the temperate areas of both the southern and the northern hemispheres. It is very abundant in Australia. Most of the species are exceedingly variable and singularly lacking in the obvious characters which are useful for quickly identifying plants. In most regions where *Pittosporum* is well represented it is recognized by systematists as a confusing and difficult genus.

This paper presents the results of an extensive study of *Pittosporum* in Asia, where the genus has had an important evolutionary center and now has its most northerly extension. The area includes not only continental Asia but also floristically similar Japan, the Bonin Islands, Ryu-Kyu, and Formosa. Most of the *Pittospora* in this area are endemic. It was not until the latter part of the 19th century that China was open to exploration by the western countries. With ample material, the product of recent explorations, I have recognized about 30 species from China.

HISTORY

The first member of the genus *Pittosporum* known to European botanists was collected by Kaempfer during his sojourn in Japan, 1690–1692. This was later illustrated and described as *Tobira* by him in Amoenitatum Exoticarum 5: 796, *t. 797* (1712). No reference to this plant appears in Linnaeus' Species Plantarum (1753); but in Thunberg's Flora Japonica 99 (1784) it is described as *Evonymus Tobira*. It appeared as *Pittosporum* for the first time in Aiton's Hortus Kewensis ed. 2, 2: 27 (1811), where it is listed with four other species, all with brief descriptions. *Pittosporum pauciflorum* was described by Hooker & Arnott in Botany, Beechey's Voyage 168, *t. 32* (1833) from the Beechey's collection of Chinese plants. In 1846 *P. glabratum*, a plant introduced to England from China, was described by Lindley in Journal, Horticultural Society of London 1: 230. These species are of historic importance because China

had remained a closed country for European botanical exploration until the year 1842. Previous to that time the known species of *Pittosporum* from China were all from in and around Macao and Canton. In 1886 only four species were listed by Forbes & Hemsley in Index Florae Sinensis 1: 58. As plant exploration proceeded, it became increasingly evident that the genus had an important center in southern and southeastern China. Seven species and one variety were recorded by Rehder in Plantae Wilsonianae 3: 326–330 (1917). The impetus given to botanical exploration by the opening of China to western botanists during the latter part of the 19th century and in the present one is manifest in the extensive collections distributed into various herbaria. Many of the new species of *Pittosporum* have been described during this period and reported in numerous botanical periodicals. Since the references are listed in the text with the descriptions of the species and the subsequent discussions, it seems quite unnecessary to review them here or to list them in the form of a bibliography at the end of this work.

Most of the species in India were known by the middle of the 19th century. Roxburgh described the earliest one in Flora Indica 2: 39 (1824) as *Celastrus*. Wight was the first botanist in that country to recognize the genus *Pittosporum;* he described three species in his Prodromus 1: 153–154 (1834). By the time that Hooker prepared his great work for India nine species were known, and these were briefly described by him in the Flora of British India 1: 198–200 (1872). As far as the Indian *Pittospora* are concerned, this is still the most valuable reference.

Among the treatments of the genus as a whole, a few are of importance to our area. De Candolle's Prodromus 1: 346 (1894) included eleven species, three of which occurred in the area under study. Putterlick, Synopsis Pittosporum (1839), reviewed and enumerated 36 species, of which nine were found in our area. Pritzel's treatment of the family Pittosporaceae in Engler and Prantl, Die Natürlichen Pflanzenfamilien, ed. 2, 18a: 265–286 (1930), dealt mostly with the general aspects of the genus and gave a synopsis of all the species occurring in all the regions. It is, indeed, the most important item in the extensive bibliography of the genus.

MATERIALS

The main source of materials on which this study is based is the vast collections of *Pittosporum* from China and India which have accumulated in the herbarium of the Arnold Arboretum. These have been supplemented by loans from the Gray Herbarium, from the New York Botanical Garden, and from the Sibpur Botanic Garden, Calcutta, India. Several type specimens have been obtained from the herbarium of the Royal Botanic Garden, Kew, England. In citing specimens from the above herbaria the following symbols have been employed: (A) = Arnold Arboretum; (GH) = Gray Herbarium; (NY) = New York Botanical Garden; (C) = Sibpur Botanic Garden; and (K) = Kew.

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MORPHOLOGY AND TAXONOMIC CRITERIA

General habit: The Asiatic species are small trees or shrubs. They are mostly upright, but a few, such as *P. heterophyllum* var. *sessile* and *P. saxicola,* are low and spreading. Young shoots in several species and especially in *P. eriocarpum, P. ferrugineum,* and *P. formosanum,* are covered with dense induments but later become glabrescent; most species, however, are glabrous even when young. In herbarium specimens the twigs are usually brown to brownish grey and commonly speckled with small whitish lenticels. In *P. parvifolium,* however, the lenticels become very prominent collar-like slits on the bark. Similar collar-like lenticels are prominent on the pedicels of the fruit in *P. gagnepainianum.* Leaf-scars vary in size according to the stoutness of the petioles. In shape they are roundish to reniform and often more or less triangular. All show the marks of three vascular bundles. These features are of minor value and of little use in the classification of the Asiatic species of the genus. Branching usually is either simple or verticillate. The behavior of the leading shoot may be described as follows:

1. Vegetative in the first year.
   a. Producing terminal leafy inflorescences the second year and also a new leading vegetative shoot or shoots from the lower axils; or
   b. Producing leafless pseudoterminal inflorescences the second year from the buds congested at the apex, and also a new leading vegetative shoot or shoots.

2. Vegetative and terminating in an inflorescence the first year, and the second year producing a new leading vegetative shoot or shoots from its lower axils.

Leaves: The leaves of *P. truncatum* var. *tsaii* are always somewhat lobed, as are also occasional leaves in specimens of *P. kerrii* from Upper Burma. Other species, however, all have entire leaves. In all species the actual margin of the leaf is edged by a distinct colourless thick cuticle. In size and shape the leaves are variable, often within the species. In average size they may vary from 2 cm. to over 25 cm. long. *Pittosporum adaphniphylloides*, *P. daphniphylloides*, and *P. napaulensis* are notable among our species for their large oblong leaves. *Pittosporum adaphniphylloides* has the largest ones, these often measuring over 25 cm. in length. The smallest and narrowest leaves, among the Asiatic species, are possessed by *P. saxicola*. In *P. truncatum* the leaves are obovate with an abruptly acute apex. It should be noted that *P. heterophyllum* has leaves obovate and abruptly acute as well as oblanceolate. Broadly oblanceolate leaves are characteristic of many species. Small, narrowly lanceolate leaves are possessed by *P. humile* and *P. pulchrum*, while much larger leaves of similar outline are found in *P. glabratum* var. *neriifolium*, *P. podocarpum* var. *angustatum*, *P. oblongilimbum*, and *P. pentandrum*. Broadly obovate leaves are common to many species, such as *P. sahnianum*, *P. kerrii*, *P. floribundum*, and *P. glabratum*. There is accordingly great variation in size and shape, from small to large, and from linear and oblong through lanceolate and elliptic to ovate or obovate. In spite of such variation, the leaf-shape, combined with various types of leaf-apex, provides very useful characters for species recognition in this region. Such closely related and intergrading species as *P. balansae*, *P. confertum*, and *P. baileyanum* can usually be recognized solely by their distinctive leaf-shapes.

In nearly all of our species the leaves are glabrous or glabrescent, the chief exception being *P. eriocarpum*, which has dense and permanently tomentose foliage. The indument of this latter species is composed of characteristic yellowish brown hairs which densely clothe the leaves and the young twigs. This distinctive pubescence provides a character by which the species may easily be distinguished from all other Sino-Indian congeners. Conspicuous rusty hairs are present on young leaves and shoots of *P. ferrugineum*. On older leaves, however, these hairs are deciduous and leave small projecting cutinized basal cells that appear stump-like when the cuticular epidermis is prepared and observed under high magnification. In *P. baileyanum* and *P. balansae* brown or blackish brown hairs may persist along the veins on the older leaves.

The colour of the leaves on the dried specimens in a few species departs from a nondescript brown and becomes distinctive. In *P. kobuskianum* it is pale green. In *P. napaulense*, *P. ferrugineum*, and *P. kerrii*, it is dark deep brown. Phyllotaxy is frequently obscured due to the tendency of the leaves to crowd towards the ends of the branches. On all elongating

shoots the lower leaves are loosely arranged and clearly alternate. Upwards along the shoot, by gradual transition, the leaves become more closely spaced, and towards the ends of shoots they are decidedly crowded. This crowding of the leaves (towards the ends of the branches) is caused by suppression of the internodes and not by crowding of many leaves at a node. Most important, it results in the congestion of axillary buds and eventually in verticillate branches, a characteristic feature of all our species.

Petioles: The petioles are very short. They may be suppressed or up to 3 cm. long. In *P. heterophyllum* var. *sessile* the leaves are sessile; in *P. saxicola* they are subsessile. Petioles vary in the rest of the species. The average length is from 5 to 15 mm. The length of the petiole generally decreases from the lower leaves upwards or *vice versa*. Hence their length is of little value in classification. The petioles may be either slender or stout and they vary in this regard within the species. They are rounded on the lower surface. On the upper surface they are channeled, with the edges slightly winged due to the decurrent margin of the blade.

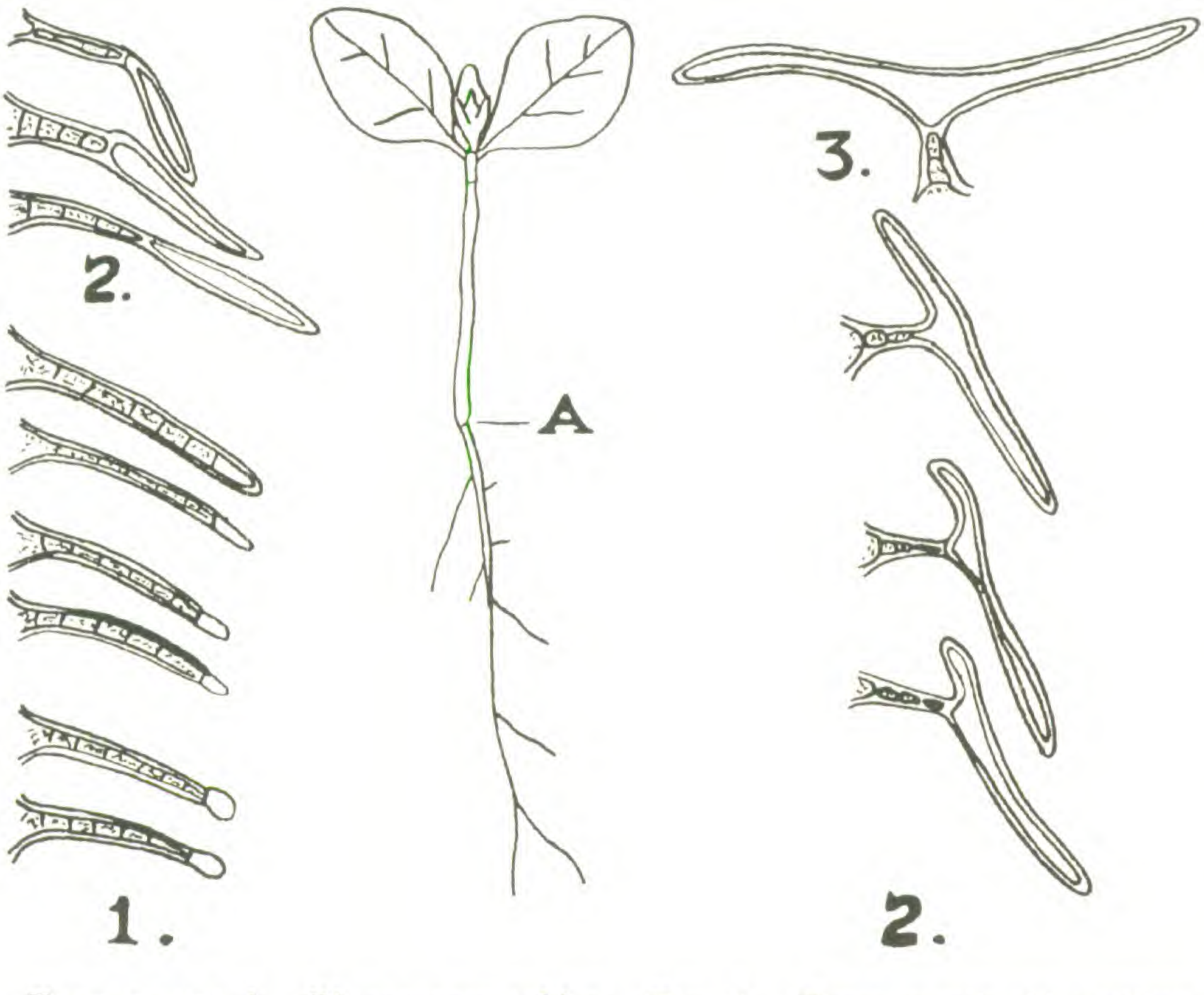
Midrib and **veins:** The convex midrib is always prominent on the lower surface of the leaf. The veins may be evident or obscure, though they are usually prominent on the lower leaf-face. In number they are not characteristic of any species or group of related species. In our region the most distinctive veins are found in *P. nervosum*. In that species they are prolonged to form a distinct submarginal vein on the lower face. A similar development is found in *P. perryanum* and occasionally in *P. napaulense*.

Veinlets and **areolae:** On the lower surface of the leaf the veinlets may vary from slightly emersed to prominent. They are never prominent on the upper surface. The areolae formed by the veinlets are more or less isodiametric and may vary in size from species to species. They are extremely small in *P. pauciflorum* and very big in *P. perryanum*. In *P. kerrii, P. adaphniphylloides,* and *P. napaulense* they may be very conspicuous because of the prominence of the veinlets forming their margins. In many species they frequently contain one or more free ends of veinlets. These developments, however, are rarely constant in a species and may be ecological in origin.

Indument: The different variations of trichomes characteristic of the genus are all well displayed on the hypocotyl and the epicotyl of the young seedling of *P. tobira*. On a seedling 6 cm. long and about three months old the changes in the number of cells and in the shape of the apical cell of the trichome are remarkable and very interesting. Between the ground level and the cotyledons the hairs are all simple, uniseriate, and of equal length. The lowest hairs are 8-celled and have their apical cell small and rounded. Those occurring higher up along the hypocotyl have their cell numbers gradually reduced to 5 or 6. The length of the trichomes remains the same by proportional increase in the length of the apical cell. Above

the cotyledons further changes occur. The 4- or 5-celled trichomes on the epicotyl show every transition from simple form to T-shaped. This results from the apical cell changing its orientation, becoming more and more clearly branched at the bent base, and gradually lengthening horizontally from the bend to form another arm of the T-shaped trichome. Every transition from straight to bent, from unequal to equal arms is exhibited. In the seedling studied, therefore, there is complete transition, within 6 cm. from the ground level to the tip of the epicotyl, from 8–6-celled uniseriate trichomes to 6–3-celled T-shaped trichomes. All the series of changes in the apical cell that finally produce the T-shape take place within the epicotyl, which is hardly over 1 cm. long.

On the herbarium specimens studied no glandular hairs were observed, and straight hairs were infrequent. The common type of trichomes is T-shaped. These may have unequal to equal arms. The average basal stalk-cells number 6–3. The extreme reduction occurs in *P. nervosum*,



TEXT-FIGURE 1. *Pittosporum tobira:* FIG. A. Three-month-old seedling. FIG. 1. Trichomes on the hypocotyl. FIGS. 2, 3. Trichomes on the epicotyl and leaves.

where the stalk-cells in the trichome number 1 or 2 and the arms are short and blunt. Plants with this condition appear almost completely glabrous to the naked eye. Species like *P. eriocarpum* and *P. ferrugineum* are thickly covered with T-shaped trichomes. In *P. eriocarpum* the arms of

the hairs are very long and interwoven. They form a cobweb-like canopy supported by stalks which are long and 6-celled. The basal cell of the stalk, both in *P. ferrugineum* and *P. eriocarpum* is thickly cutinized and continuous with the epidermis. When the trichomes break off these basal cutinized cells remain and under a microscope appear stump-like on the epidermis. When an indument is present, the T-shaped trichomes with equal arms are the type prevailing on the leaves, on the young stems, and on the inflorescences.

On the ovary the trichomes have unequal arms borne on a short stalk. The shorter arm is usually blunt and directed towards the base of the ovary. The longer arm is always directed towards the apex of the ovary. Uniseriate short straight hairs with small rounded apical cells are sometimes developed on the margin of sepals. The density, the persistence, and the colour of the indument are not uniform and constant except in a few species like *P. eriocarpum* and *P. ferrugineum*. Such characters appear to be of little or no value in the recognition of species.

Epidermal cells: The leaf cleared in the sodium hydroxide solution, or epidermis prepared by the maceration method with Sudan IV staining, shows, under high magnification, epidermal cells either angulate with polyhedrous outline or irregular with an undulate outline. The former type is found in species like *P. dasycaulon, P. eriocarpum,* and also in *P. neelgherrense, P. napaulense, P. floribundum, P. brevicalyx, P. ceylanicum, P. truncatum, P. heterophyllum,* and *P. saxicola,* and the undulate outline is well illustrated in *P. nervosum.* Among closely related species the size and outline of the epidermal cells may remain relatively constant, even though the whole leaf may differ greatly in size and outline. This is clearly shown in the following comparison:

Species	Leaf Size (*in millimeters*)		Stomatal Size (*microns*)		Epidermal Cell Size (*microns*)
	Length	*Width*	*Length*	*Width*	
P. truncatum China Henry 5513	60	20	23–30	21–22	22–30
P. heterophyllum China Schneider 1346	40	10	21–30	21–24	21–32
P. saxicola China Wilson 3182	15	5	33–40	20–30	20–40

Striate leaf-cuticle was observed in most of the species examined. The striations are made up of granular bead-like thickenings. They follow the outline of the epidermal cells and also radiate out from the larger

stomata and from the persistent bases of deciduous trichomes. *Pittosporum eriocarpum*, *P. napaulense*, and *P. ferrugineum* illustrate this particularly well.

The stomata show slight differences in size and also in the number per given area, but are otherwise constant. They are of the rubiaceous type. The oxalate crystals are needle-like. They can occur singly or in bundles in one and the same leaf in some species.

The leaf apex: Among the TRIVALVAE, members of the tobira-complex have leaves with an obtuse, rounded, and often emarginate apex. On the other hand, those of the glabratum-complex of the TRIVALVAE all have the apex acute or acuminate. Among the BIVALVAE, *P. viburnifolium* and *P. ceylanicum* are characterized by an obtuse or rounded apex. In *P. heterophyllum*, *P. saxicola*, and *P. humile*, as well as in *P. truncatum*, the apex is minutely apiculate. *Pittosporum johnstonianum* and *P. chatterjeeanum* are characterized by a long-acuminate apex. *Pittosporum sahnianum* and some specimens of *P. kerrii* have characteristically stouter, as well as shorter, somewhat curved apical prolongation.

Though varying in a few species, in general the apex is the most useful and constant vegetative character in defining the species. Indeed, in our region the species with 3-valved capsules may be divided into two convenient and very natural groups on the apex-shape alone.

Inflorescence: The inflorescence is determinate in development. Its cymose clusters show great diversity in degree of branching. Since there is much confusion in the use of terms describing such inflorescence, the following terminology has been adopted:

1. Terminal; primarily floriferous shoots or single flowers produced apically on the stem and branches. These terminate by flowers and produce no terminal bud for future elongation. This type of inflorescence may be classified as follows:
   a. Paniculate type.
   b. Compound-corymbose type.
   c. Solitary flowers.
2. Pseudoterminal: developing directly from buds crowded about the apex of the shoot of the previous season.
   a. Compound-umbellate type.
   b. Sub-umbellate (cymose-cluster) type.
   c. Umbellate (cluster of single flowers) type.
   d. Solitary flowers.
   e. Solitary cymes.
3. Lateral: arising from axillary buds along the shoot.
   a. Axillary: subtended by well-developed leaves and arising directly from the axil or from axillary short shoots.
   b. Intercalary: subtended by bracts or very reduced leaves; and produced along a leafy young shoot. The shoot bears most of the well-developed leaves towards its apex and is terminated by a vegetative bud.
   c. Caulifloral inflorescences: produced on older leafless stems.

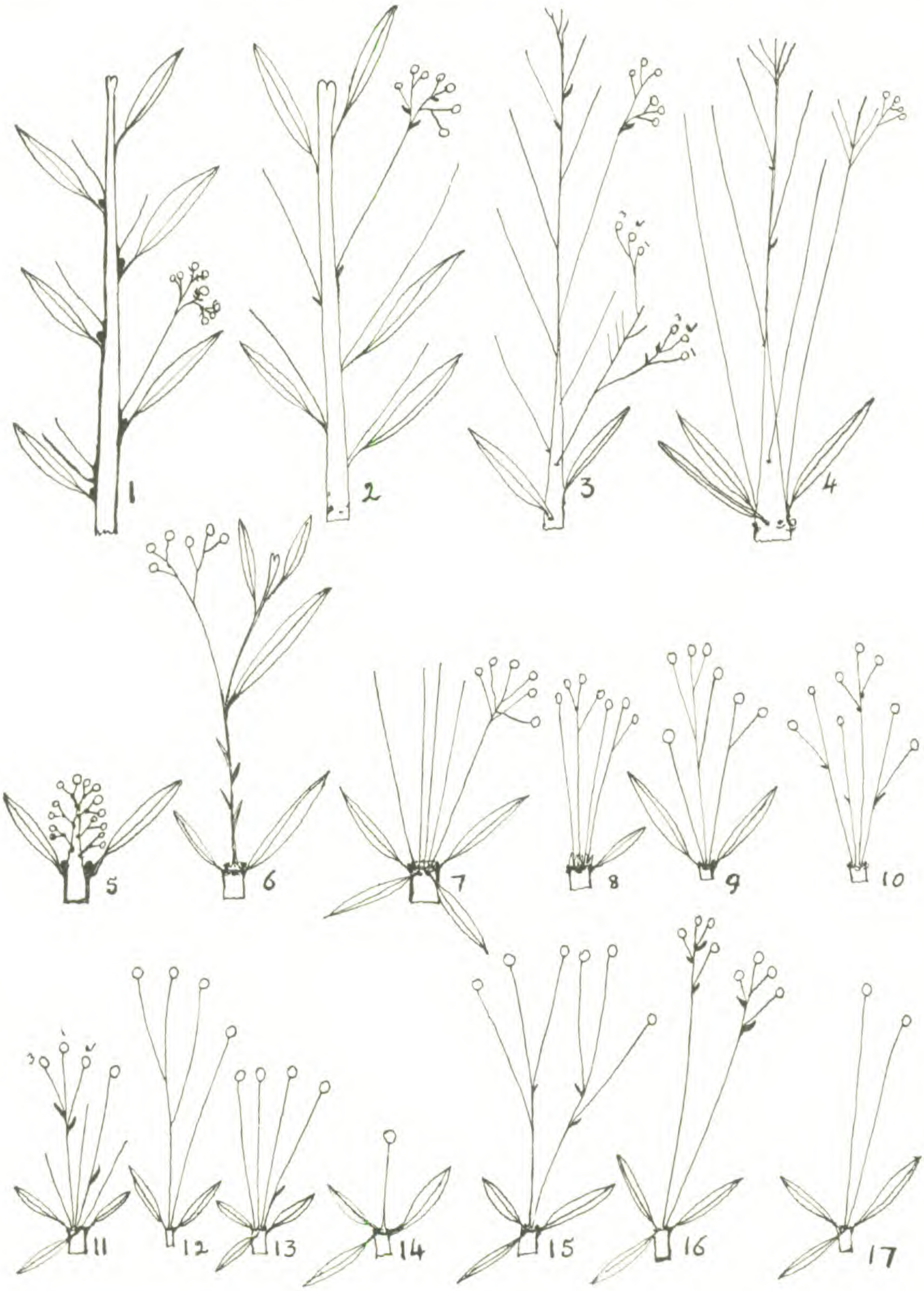
4. Supra-axillary inflorescences: arising from the uppermost of the supernumerary axillary buds and hence a few millimeters above the subtending petioles.

One or more of these types of inflorescence may occur in individual species or in a group of species. In *P. kerrii* terminal and intercalary are both developed; the former, however, predominates. *Pittosporum formosanum* and *P. formosanum* var. *hainanense* have only terminal inflorescences. Within *P. napaulense*, *P. floribundum*, and *P. brevicalyx* individual plants may have either terminal or pseudoterminal inflorescences. *Pittosporum johnstonianum*, *P. adaphniphylloides*, *P. daphniphylloides*, *P. viburnifolium*, and most of the TRIVALVAE are characterized by a pseudoterminal inflorescence. Speaking generally, we may say that the terminal and pseudoterminal types are most common among the species in our area. The most extreme and uncommon type is supra-axillary, found only in *P. nervosum*.

The amount of branching in the inflorescences is very variable, within a single species as well as in a series of related species. In the well-branched paniculate inflorescences the ultimate cymules are one- to many-flowered. The rays of the inflorescence may be compounded more than three times. The inflorescences, indeed, may be very complicated, often showing the fourth or fifth degree of branching. In gross appearance they may be more or less paniculate (*P. napaulense*, *P. floribundum*, *P. brevicalyx*), or compound-corymbose and pyramidal (*P. formosanum* and *P. kerrii*), or compound-umbellate (*P. johnstonianum*, *P. viburnifolium*, *P. adaphniphylloides*, *P. daphniphylloides*), or subumbellate (most of the TRIVALVAE), or umbellate (*P. sahnianum*, *P. pauciflorum*, *P. parvifolium*).

There are ample indications that the trend of inflorescence evolution in the genus is from the well-branched paniculate to the simple cymose type and eventually to the solitary flower, with all intermediary stages present. A suppression of the internodes in the main axis of the paniculate or compound-corymbose types would produce a compound-umbellate inflorescence such as that exemplified in *P. johnstonianum*, *P. adaphniphylloides*, and *P. viburnifolium*. By a reduction in the number of rays and of flowers, such compound umbels can be transformed into the clustered cymes characteristic of the TRIVALVAE. All the TRIVALVAE of our region, along with some of the BIVALVAE, have aggregations of cymes of various complexity. · In gross appearance these aggregations may be subumbellate or umbellate. In a few cases (*P. parvifolium*, *P. pauciflorum*, and *P. sahnianum*), the cymes are very reduced and the aggregation becomes merely a sessile umbel of flowers. *Pittosporum oligocarpum* has a solitary cyme, very simply organized. In species with polygamo-dioecious flowers, as *P. glabratum* and *P. podocarpum*, the flowers with short stamens are solitary, whereas those with long stamens are umbellate. The solitary flowers, where found, are evidently the result of extreme reduction. They are cymes reduced to the ultimate.

The precise stages in the development of single flowers, whether in an



TEXT-FIGURE 2. Inflorescences: FIG. 1. Supra-axillary. FIG. 2. Intercalary. FIGS. 3–5. Terminal. FIGS. 6–17. Pseudoterminal.

FIG. 1. *Pittosporum nervosum*. FIGS. 2, 3. *P. floribundum*, *P. kerrii*. FIG. 3. *P. formosanum* and var. *hainanense*. FIGS. 3, 4. *P. napaulense*. FIG. 5. *P. merrillianum*. FIG. 6. *P. podocarpum*. FIG. 7. *P. johnstonianum*. FIGS. 8–11. *P. tobira*. FIG. 9. *P. truncatum*. FIG. 12. *P. oligocarpum*. FIG. 13. *P. sahnianum*, *P. pauciflorum*. FIG. 14. *P. lignilobum*, *P. podocarpum*, *P. glabratum*, *P. crispulum*. FIG. 15. *P. chichijimense*. FIG. 16. *P. boninense*. FIG. 17. *P. parvifolium*.

umbel or solitary, merit some discussion. An umbel of single flowers could be produced by a reduction of the inflorescence in two ways: by the suppression of the primary axis of a simple, loosely branched cyme; or by reducing each cyme in a cluster of cymes to a single flower. The latter appears to be the case in our species. In most of the TRIVALVAE, the clusters of cymes show various reductions from many-flowered cymes to few-flowered ones and finally to single flowers. In many species of this group the cymose cluster is composed of 4-flowered, 3-flowered, 2-flowered, and even 1-flowered cymes. If all the cymes in the cluster were reduced to 1-flowered cymes, the result would be an umbel of single flowers. The bractlets present on the support of single flowers clearly indicate the suppression of lateral flowers in the cyme. This elimination or suppression of lateral flowers in a cyme, to produce a single flower, is well illustrated in the three endemics of the Bonin Islands. *Pittosporum chichijimense* is characterized by short-peduncled and long-pedicelled cymes in the cluster; *P. boninense* by long-peduncled and short-pedicelled cymes; and finally, *P. parvifolium* by long-pedicelled flowers in the umbel. The umbel in our species, where found, seems to be thus the result of reduction of the cymose cluster. The extreme reduction of both the cluster and cymes could result in a solitary flower. The collar-like bracts, occasionally found at the base of the pedicel of a solitary flower, probably give such indication, since they appear to be the reduced bracts of an axis whose internodes have been completely suppressed. Pedicels that arise directly from the apex of the shoot and show no external indication of suppression could be reduced cymes, since reduction seems to be the trend in our species.

Bracts and bractlets: The bracts show great variation in size and shape. In size they vary from almost the normal size of the leaf to minute. This gradation in size is very well illustrated by observing the bracts on the axis of the inflorescence of *P. formosanum*. Here the lower bracts are almost as large as the leaves; higher up they are smaller (5–3 mm. long), until at the apex they are minute. Most of the species, however, have small bracts, usually 10–20 mm. long. But the presence or absence of these bracts and their persistence, when present, are all very variable within the species.

There are scaly or membranous structures which occur in collar-like clusters at the base of young shoots or young shoots bearing inflorescences. Such a collar of extremely small bracts sometimes occurs at the base of the pedicel of a solitary flower in some species. In *P. truncatum* it often is present at the base of the young shoot bearing an inflorescence. Likewise it is present in *P. tobira* and some others. In some species these bud-bracts are deciduous and drop off very early, leaving scars at the base of the shoot.

In a few species there are small prophyll-like structures, and in *P. nervosum* somewhat bracteole-like structures which merit a few words of explanation. *Pittosporum nervosum* has one or two small bracteoles

(?) at the base of the calyx; and on the short pedicels there are one or two prophyll-like structures. The latter often occur, also, on the supports of solitary or single flowers in the umbellate clusters. The prophyll-like structures are probably the bractlets of a cyme in which the lateral flowers have been suppressed.

Pedicels and fruit-stalks: The length of the pedicels in a solitary flower or in an aggregation of single flowers varies from 5 to 50 mm. *Pittosporum parvifolium* has the longest pedicels among the single-flowered species, and the next longest are in *P. sahnianum*. In most of the species, however, the length is variable.

The length of the pedicels in cymes and in well-branched inflorescences varies from 0 to 60 mm. The pedicel is very reduced in *P. confertum* and is extremely short in *P. nervosum*. It is 40–60 mm. long in *P. chichijimense*, but in most of our species with well-branched inflorescences it is usually 0–10 mm. long; and this latter variation in the length of the pedicel usually occurs in the same inflorescence.

Pedicels at the time of flowering show very slight differences in their thickness. The slenderest are in *P. oligocarpum*, where they are almost filiform. In most of the species they are usually about 1 mm. thick. The pedicels or supports of the capsules, in some of our species, show greater variations in thickness. From flowering to the maturing of the fruit several of our species take over six months; and during that period considerable growth takes place in peduncles and pedicels. Undoubtedly this is the reason for the variation in their thickness. Furthermore, the support of a solitary capsule is often composed partially of peduncle and partially of pedicel, for the cymes may mature only one fruit. Accordingly, I have used the term "fruit-stalk" for the supports of capsules, since it may be a pedicel or a composite structure composed of peduncle and pedicel.

Flowers: The flower-buds in most of our species are oblong. A few species, *P. baileyanum*, *P. balansae*, *P. confertum*, *P. ferrugineum*, *P. undulatum*, and *P. neelgherrense*, have ovate buds.

According to field reports, most of our species bear fragrant flowers. Some of them are prized garden shrubs in tropical and subtropical gardens.

Sepals: Speaking in general, the sepals in most of our species are either free or slightly connate at base. The exceptional cases are *P. nervosum* with a shallow cup-like calyx and *P. undulatum* with a long calyx-tube which splits into two parts, one 2-lobed and the other 3-lobed. The sepals are usually membranous, but in *P. formosanum* they are somewhat coriaceous. They vary in size from 1 mm. to about 9 mm. long. Most of the species in TRIVALVAE have short sepals, usually 2–4 mm. long (with the exception of *P. subulisepalum*, which has been said to have sepals 7 mm. long, and *P. pauciflorum*, with sepals 4–5 mm. long). Among the members of BIVALVAE, the species of the undulatum-complex bear long sepals, usually 4–9 mm. long, and those of the balansae-complex have sepals 4–5 mm. long. The rest of the BIVALVAE have short sepals, usually 1–4 mm. long.

Sepals are either glabrous or hairy. Long sepals are usually hairy. Short sepals are usually glabrous, but the margin may be ciliate or fringed with hairs. The margin in most cases is membranous, or membranous and ciliate.

The shape of the sepals varies considerably. In some species it is oblong with rounded apex and with non-membranous margin, as exemplified in *P. formosanum*. In others it is oblong with obtuse or acute apex and with membranous margin, as exemplified in *P. napaulense*, *P. floribundum*, *P. kerrii*. In most of the members of TRIVALVAE it is triangular or ovate with broad base and with obtuse or acute apex. In almost all of the species bearing long sepals, the shape is usually lanceolate with acuminate apex.

In the species which bear short sepals (1–4 mm. long) there is considerable variation both in shape and size within the species, hence the sepals are of little or no help in classification. The long sepals (4–9 mm. long), however, characterize individual species or a group of species in our area, and they are of great help in delineating the species-complexes as well as individual species.

Petals: The petals, variable as to size, are usually uniform in shape. They are obovate-oblong or oblanceolate, with obtuse or rounded apex. The lower halves of the petals are erect and, whether slightly connate or not, form the tube-like part of the corolla; their upper halves, their broadest part, are imbricate in the bud and spreading at anthesis. In size the petals vary from 5 to 15 mm. long. The size varies greatly within the species, particularly in those species which are characterized by dimorphic flowers. In *P. nervosum* the petals bear a few short T-shaped trichomes on the outer surface. In other species, however, they are glabrous. According to the field reports, the colour of the petals is yellow or, exceptionally, white.

Floral dimorphism: All our species produce hermaphrodite flowers, but a tendency for the separation of sexes has been observed in several species. Indeed, the unisexual stage has been reached in some specimens of *P. undulatum*. Furthermore, the floral dimorphism observable in some of our species illustrates some of the earlier evolutionary stages in the same direction. This tendency towards unisexuality, observable in the genus, has not attracted much attention on the part of the botanists. No field observations bearing on it are available for our area.

Most of the species bear monomorphic, hermaphrodite flowers. In these the tips of the anthers usually reach to the level of the stigma or only slightly beyond it. Over ten per cent of the species bear two types of flowers. These have marked structural and functional differences and may occur on different plants or on separate twigs on the same plant. One of them has long stamens and is potentially male. The other has short stamens and is potentially female. The long-stamened flowers are superficially similar to those borne by species producing only a single type

of flower. Their anthers are always fertile and their tips reach the stigma or slightly beyond it. Their ovary, however, is slender and cylindrical (rather than plump) and, most important, tends to be infertile. Flowers of this type and also those with short stamens are regularly developed by such species as *P. glabratum, P. podocarpum, P. ferrugineum, P. illicioides,* and *P. crispulum.* From species to species short-stamened flowers appear with various modifications. They may possess stamens with poorly developed anthers, the tips of which reach only partly up the style (e. g., some specimens of *P. sahnianum* and *P. heterophyllum*). In *P. glabratum, P. podocarpum, P. illicioides, P. ferrugineum,* and *P. crispulum,* the filaments as well as the anthers may be poorly developed and both appressed to and hardly surpassing the body of the ovary. The anthers are abortive and sterile. An ultimate stage of reduction is found in those flowers in which the stamens are represented only by gland-like structures (*P. undulatum*). In such short-stamened flowers the ovary becomes correspondingly more and more plump and fertile, and the flower as a whole more and more distinctly female.

These tendencies are expressed in one stage or the other in many species other than those cited above. They are not restricted to any one geographic area. Collections of Wilson and of Dummer from Uganda, Africa, belonging to *P. ripicola* Leonard, Bull. Jard. Bot. Bruxelles 20: 47 (1950), illustrate it. Wilson's collections bear flowers with short stamens in which the fllaments hardly surpass the ovary and the anthers are abortive; whereas Dummer's collection bears long-stamened flowers with perfect anthers. In *P. ferrugineum,* the specimens from Malaysia exhibit the same conditions. Koorders & Valeton, Boomsoorten Java, Bijdrage 4: 54 (1896), mentioned the floral dimorphism in that species. *Pittosporum undulatum* I have mentioned previously. It appears that this floral dimorphism is widespread among the members of the genus. It is probable also that more than one of the modifications in the flower can occur in one and the same species. Hamilton, Proc. Linn. Soc. New South Wales ser. 2, 19: 583–4 (1894), has observed short stamens with abortive anthers in *P. undulatum,* and I have seen stamens completely reduced to gland-like structures in the same species.

It is to be noted that the floral dimorphism described is not heterostyly. There is no inverse lengthening or shortening of styles to correspond with the short and long stamens. The ovary may vary in fertility, but the style-length remains constant. The conspicuous differences in the two types of flowers are chiefly those of the stamens.

The following correlations associated with the floral dimorphism in the genus are noteworthy:

1. Among the glabratum-complex, in the species characterized by dimorphic flowers, the short-stamened flowers are robust and are borne usually solitary, in single-flowered inflorescence; whereas the long-stamened flowers are slender and are borne in clusters.

2. In *P. ferrugineum* there is no difference in the form of inflorescence,

but there are differences in the flower-buds. The buds of short-stamened flowers are usually conical and short. Those of the long-stamened flowers are cylindrical at the base, dilated above the middle, and conical at the apex, and are usually longer.

3. In such species as *P. sahnianum* and *P. ripicola,* the long- and short-stamened flowers are similar in form and occur in similar inflorescences.

Pollen-grains: Concerning the pollen morphology of the family very little has been recorded. Wodehouse and Erdtman say nothing of this family. Fritzsche, Beitr. Kenn. Pollen 25 (1832), merely lists *P. undulatum* as having smooth grains. Mohl, Ann. Sci. Nat. Bot. sér. 2, 3: 338 (1835), though he mentions the pollen of only *P. undulatum,* merely remarks that it resembles that in the Aquifoliaceae. Schnizlein, Kerr. Fam. Nat. Veg. 4: *t. 234, f. 9–10* (1870), gives figures of pollen-grains of *P. undulatum,* but the figures are non-informative. The measurements of pollen-grains of *P. undulatum* and *Sollya heterophylla* are given by Edgeworth, Pollen, ed. 2, 64 and 89, *t. 22, f. 373* (1877), as "8–9/6000" (about 33 microns). He describes them as "pale yellow, elliptic, with 3-bands and slits . . ." Selling, Stud. Hawaii. Pollen Stat. part 2 in Bish. Mus. Sp. Publ. 38: 130–132 (1947), reports on two Hawaiian species.

Billardiera scandens,	28–31	microns	*Pittosporum*		
Bursaria spinosa,	15–18	"	*eriocarpum,*	24–27	microns
Cheiranthera linearis,	30–36	"	*P. floribundum,*	27–30	"
Hymenosporum			*P. glabratum,*	35–40	"
flavum,	40–45	"	*P. heterophyllum,*	33	"
Marianthus candidus,	30–31	"	*P. mannii,*	24–27	"
Pittosporum			*P. neelgherrense,*	31–34	"
baileyanum,	30–33	"	*P. oblongilimbum,*	47–50	"
P. balansae,	30–34	"	*P. rehderianum,*	40–42	"
P. ceylanicum,	31–33	"	*P. saxicola,*	27–30	"
P. crispulum,	40–50	"	*P. tobira,*	31–34	"
P. daphniphylloides,	33–38	"	*P. truncatum,*	27–30	"
P. dasycaulon,	32–34	"	*Pronaya elegans,*	27–30	"
			Sollya heterophylla,	31–34	"

I have studied a representative of all the genera in the family and about 26 species of the genus *Pittosporum.* Preparation of the pollen was by the acetolysis method [Erdtman, G. Introd. Poll. Analysis 29 (1943)]. All descriptions of the sculpturing of the exine was from these mounts so prepared. Measurements of the grains were averaged, based on the permanent mounts supplemented by 30 temporary ones prepared with lactic acid.

The Pittosporaceae are characterized by "small" and "medium" size grains. The smallest noted is 15–18 microns. The largest is 45–50

microns. All intermediate sizes may be found. The prevailing size in most species, however, is between 30 and 40 microns. The grains are spherical to oblongish and all are tricolpate, rarely tetracolpate (Selling l.c.). The furrows converge and taper. The germ-pores are in the equatorial regions of furrows. The reticulate sculpturing of exine is made up of granular thickenings. The average size and structure of the grains in 25 species may be summarized as follows: Tricolpate, grain-size 15 to 50 microns, roundish to oblongish; germ-pore in the middle of the germ-furrows; exine coarsely reticulate through faintly reticulate to almost smooth (inconspicuously reticulate).

Ovary: The ovaries in our species are usually two- or three-carpellate. Occasionally 4 or 5 carpels may develop. These are exceptional, however, and are found only among the TRIVALVAE and not among the BIVALVAE. At anthesis the ovaries are usualy ovoid or obovoid and measure from 3 to 7 mm. long, including the stipe when present. The latter varies from 0 to 2 mm. long.

In over 85 per cent of our species the ovaries are hairy in various degrees. Species with glabrous ovary, *P. glabratum*, *P. rehderianum*, *P. pentandrum*, *P. formosanum*, *P. humile*, and *P. heterophyllum* var. *sessile*, are easily recognizable and are constant in this feature.

The colour of the trichomes on ovaries is either brown or whitish, rarely rusty brown. Shape and size of the ovary do not render any help in the characterization of the species. The colour of the young ovaries in the herbarium is not constant; most of them are light brown, but in *P. formosanum* the ovary is glabrous and dries black; in *P. glabratum* it is glabrous and dries light brown. The style is uniformly glabrous in all our species.

The young ovary has as many locules as there are carpels, or it is semi-unilocular or unilocular. The mature capsules, however, are always unilocular. The fresh young ovary in cross-section has been diagrammed many times, showing axile placentae. In the description of the herbarium specimens the placentation is given as parietal. This is not contradictory. In the young ovary the placental ridges converge and meet along their whole length or only below the middle. Thus in the very young stage the ovary may appear to have as many locules as there are carpels, and the juxtaposed placentae appear axile. In an incompletely unilocular ovary only the basal cross-section of the young ovary shows the axile placenta. But in any case, as the ovary begins to mature and enlarge, the placental ridges retreat. In the incompletely unilocular ovary the aperture between placental ridges widens from top to bottom as the seeds develop. The mature capsules are always unilocular with parietal placentation.

Capsules: The capsules in all our species have a relatively smooth outer surface. They vary considerably in shape and size. In general, members in TRIVALVAE bear large capsules which are longer than broad, or when globular are over 1 cm. in diameter. The largest are in *P. ligni-*

lobum, often measuring 3 cm. long and 2 cm. thick. The smallest are in *P. oligocarpum*, less than 1 cm. long. In shape they vary from ellipsoidal to obovoid or pear-shaped or globular. In cross-section they may be distinctly circular or somewhat 3-angled. In *P. glabratum* and *P. podocarpum* they are usually pear-shaped. In *P. trigonocarpum* and *P. sahnianum* they are ellipsoidal and angulate. In *P. boninense*, *P. chichijimense*, and *P. parvifolium* they are globular. In *P. tobira*, *P. makinoi*, and *P. lutchuense* they are globular and angulate.

Among the BIVALVAE most of the species bear capsules about the size of a pea. Such small capsules are produced abundantly in *P. floribundum*, *P. napaulense*, *P. kerrii*, *P. formosanum*, *P. johnstonianum*, *P. daphniphylloides*, and scantily in *P. heterophyllum*, *P. tetraspermum*, and *P. truncatum*.

About 25 per cent of the species in BIVALVAE bear large capsules, which are longer than broad. They may be laterally compressed and accordingly either quadrangular or circular in cross-section. In *P. confertum*, *P. baileyanum*, and *P. balansae* the compressed fruits may have an undulate outline due to contrictions between the seeds. The distinctly cylindrical capsule is produced by *P. henryi*.

Valves: The fruits being loculicidal, morphologically the valves are composed of halves of adjacent carpels. As a result the parietal placenta occupies the mid-line on the concave inner face of each valve. Externally the valves are convex and homogenous. There is no median vein or depression to suggest its dual nature.

In lateral outline the open valves vary from obovate-oblong to oblong and elliptic or almost circular. With the globular capsule most abundant with our species, the circular valve is the most common with us.

The dry valves in most species have numerous striations diverging from either side of the placenta in a pinnate arrangement. Such striations are usually lacking in *P. glabratum* and *P. chatterjeeanum*. A lack of striation appears to be correlated with a yellowish colour and a lack of surface secretion. In most of our species the striate inner face of the valve dries brownish and is coated with a somewhat lustrous resinous secretion.

The valves differ somewhat in their thickness. They vary from less than 1 mm. to as much as 4 mm. in thickness. All members of the tobira-complex have woody valves about 4 mm. thick. *Pittosporum glabratum* and *P. podocarpum* generally have somewhat coriaceous valves. The other members of the glabratum-complex have them usually woody.

Seeds: The seeds vary greatly in number, size, and shape. The number varies from many (i.e., 16 or more) to as few as four in each capsule. Four seeds per capsule is constant with some species such as *P. tetraspermum*, *P. floribundum*, *P. kerrii*, and *P. napaulense* var. *rawalpindiense*.

In size the seeds vary from 2 mm. to 7 mm. in length; in shape they are roundish or reniform to irregular; and in colour usually red or dark

red. Such species as *P. glabratum* and *P. podocarpum* in the TRIVALVAE, and most of the balansae-complex in the BIVALVAE have roundish (7 × 5 mm.) red seeds. The tobira-complex has mostly reniform (7 mm. long) darkish red seeds. Four-seeded species in the BIVALVAE have somewhat reniform darkish red seeds. In the remaining species the seeds are usually small and irregular and generally similar.

The seeds are coated with a glutinous or resinous substance in all of the species. It is from this character that the genus derives its name. In *P. merrillianum* the seeds have an arilloid covering which forms a dry reddish coat over blackish red seeds. In most of the open capsules on the herbarium specimens the exposed seeds appear dry. Capsules opened afresh, however, show oily or resinous-coated seeds.

Seedlings: Germination of *Pittosporum tobira* (Japan, Ligetaka, *Suzuki 391.052* was studied; (seeds, 7 mm. long, 3 mm. wide, covered with glutinous substance; indiscernible minute embryo imbedded in the horny endosperm close to the hilum, on the concave face of the reniform seed). Germination was very slow, and from sowing to full expansion of the cotyledons it took over three months.

The radicle emerged first, breaking through the seed coat. The hypocotyl became 3–4 cm. long, carrying the cotyledons and testa above the soil. The cotyledons eventually freed themselves, dropping the testa. At first the epicotyl was extremely small. The first pair of leaves was developed very slowly. Though the internode is indistinct, the differential development of the leaves suggests the alternate nature of the phyllotaxy.

The radicle is very slender and grows longer than the hypocotyl; it measured over 6–8 cm. in length when the hypocotyl was about 4 cm. long. It developed very few lateral roots. The viability of the seed was good.

The cotyledons were epigeous, two in number, almost sessile. On full development they were 2 cm. long and 1.5 cm. wide and oblongish ovate and obtuse. They were shining dark green and bore silvery white hairs along the veins.

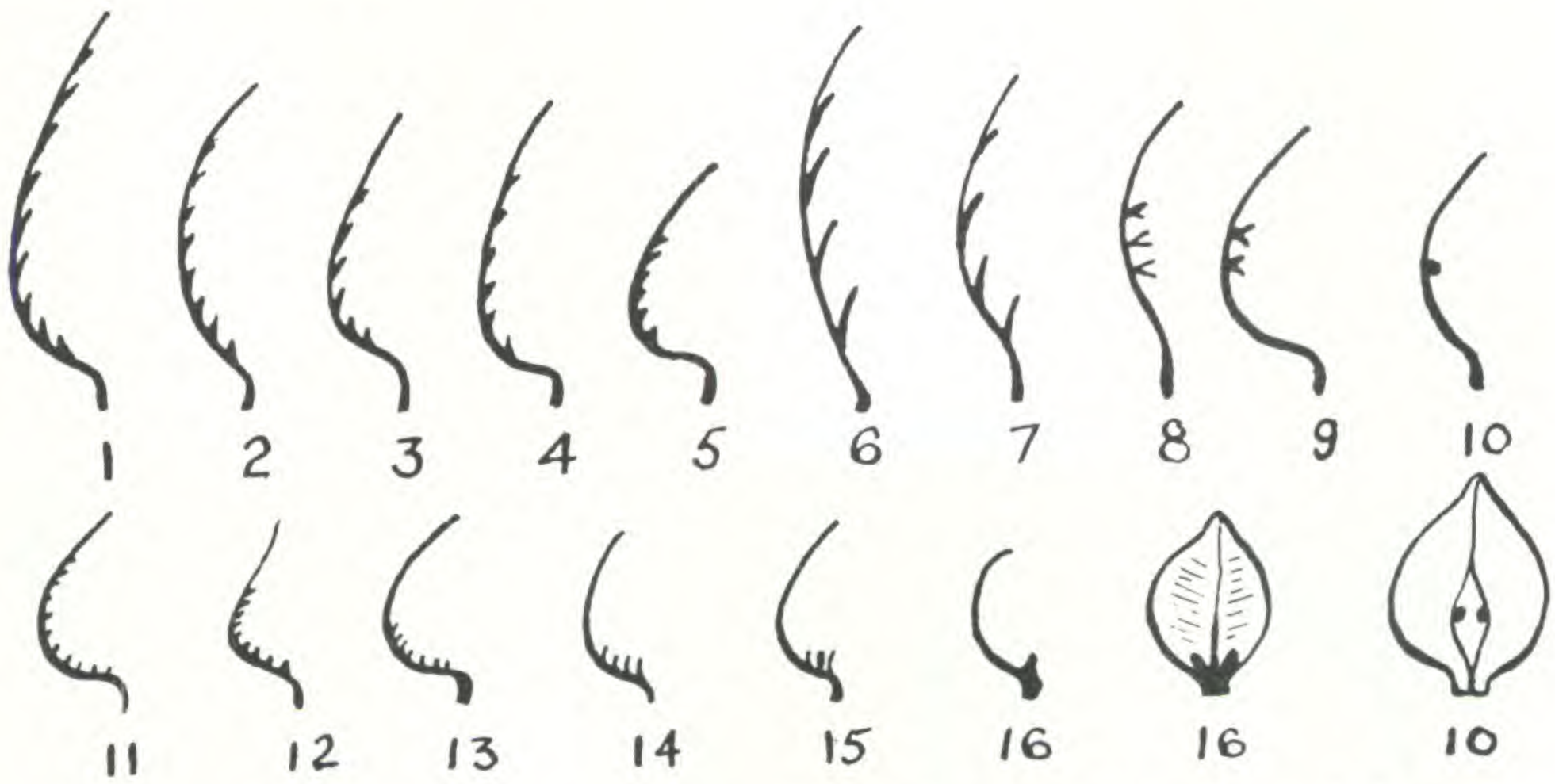
According to Lubbock, Seedlings 1: 200–204 (1892), *P. phillyraeoides* has 2 cotyledons, lanceolate and acute; *P. parvifolium* has 2 or 3 cotyledons, lanceolate and obtuse; *P. crassifolium* has 2 or 3 oblanceolate obtuse cotyledons; *P. erioloma* has 5 cotyledons which are in a whorl, lanceolate and subacute.

Placenta and funicles: The placenta occupies the mid-line on the inner face of each valve. Its fertile portion is usually elevated to form a placental ridge. This ridge varies greatly in length as well as in position. It may be developed along the whole length of the placenta or be restricted to its middle or base. It fails to be prominent and well marked only in a few species.

The funicles are either ribbon- or peg-like. They are borne along the placental ridge in two close parallel ranks (i.e., biseriate); and are so distributed as to appear either oppositely or alternately arranged along the ridge.

The funicles in *P. lignilobum* among the TRIVALVAE are many, biseriate, and borne along the whole length of the placenta. In *P. glabratum* and *P. podocarpum* they are few (8–4) on each ridge and alternate along the whole length of the placenta. In *P. trigonocarpum* and *P. sahnianum* they are biseriate, 6–8 in number and distributed along the middle sector of the placenta. The basal and apical portion of the placenta is infertile. *Pittosporum kobuskianum* develops only 4 funicles on each placenta. They are arranged in pairs at the middle.

The distribution of funicles in the large-capsuled species in the BIVALVAE shows variations similar to those in the TRIVALVAE. In *P. gagnepainianum* the funicles are many and biseriate. In *P. balansae, P. confertum, P. baileyanum,* and *P. chatterjeeanum* there are usually only four funicles on each valve. These alternate all along the placenta. In *P. henryi* there are six funicles on each valve, and these are restricted to the middle. In *P. merrillianum* there are only two funicles, and these are located at the middle of each placenta.



TEXT-FIGURE 3. Funicular distribution on placentae: FIGS. 1–10. TRIVALVAE and large-capsuled BIVALVAE. FIGS. 11–16. Small-capsuled BIVALVAE.

FIG. 1. *Pittosporum lignilobum.* FIGS. 2, 3. Tobira-complex. FIG. 4. *P. trigonocarpum.* FIG. 5. *P. sahnianum.* FIG. 6. *P. glabratum.* FIG. 7. *P. baileyanum, P. confertum.* FIG. 8. *P. henryi.* FIG. 9. *P. kobuskianum.* FIG. 10. *P. merrillianum.* FIGS. 11, 12. Undulatum-complex. FIG. 13. *P. johnstonianum.* FIG. 14. *P. formosanum.* FIG. 15. *P. napaulense.* FIG. 16. *P. tetraspermum, P. kerrii, P. floribundum.*

The distribution of funicles in the small-capsuled species of BIVALVAE show quite a different pattern. *Pittosporum truncatum, P. eriocarpum, P. undulatum, P. ceylanicum, P. ovoideum,* and *P. dasycaulon* all have small and many funicles on each placenta. Only the apex of the placenta is infertile. In *P. napaulense, P. formosanum,* and *P. saxicola* there is a definite number of funicles and they are borne along the basal and supra-

basal part of the placental ridge. From the middle and towards the apex the placenta is infertile. In *P. floribundum*, *P. kerrii*, and *P. tetraspermum* there are only two funicles at the base of each valve. The whole length of the placenta on the valve is infertile.

It is evident from the foregoing that the number of funicles on a placenta varies from numerous to 8, 6, 4, or 2 on each valve. In turn these have a definite position on the placenta. These characteristic numbers, combined with their positions on the placenta, offer interesting characters in the classification of our species.

Distribution and interspecific relations: The species treated here cover the countries from the Bonin Islands, Japan, and the islands of Ryu-Kyu and Formosa to China, Indo-China, Siam, Burma, and India. China has the greatest concentration of species in the Asiatic regions, and there the genus makes its most northerly incursion into this hemisphere. In Asia the northern limit of the genus extends from southern Japan and Korea to Kiangsu in China, thence westward into the Yangtze drainage to eastern Sikang, and thence through Yunnan to the Indian outer Himalayas as far as Rawalpindi.

The islands of Bonin have four endemics, *P. boninense*, *P. chichijimense*, *P. parvifolium*, and *P. bicarpellatum*, as well as an endemic variety of *P. tobira*. The relationships of these plants are with species of Japan on the one hand and with those of the Ryu-Kyu and Formosa on the other. They have no close allies among the Indian *Pittospora*. *Pittosporum tobira*, most common in Japan, occurs also in the coastal provinces of China. It has close relatives on the islands of Ryu-Kyu and Formosa, but none in India. *Pittosporum tobira* var. *macrophylla* and *P. illicioides* are apparently endemic to Japan. The only *Pittosporum* in Korea is *P. tobira*. In the Ryu-Kyu Islands *P. lutchuense* is the only member of the genus. Though endemic, it closely resembles species of both Japan and Formosa. On the whole, members of the genus in the Ryu-Kyu and Bonin Islands have more resemblance to those of Japan than to those of China. Their relationship with the species of China seems to be through those of Formosa.

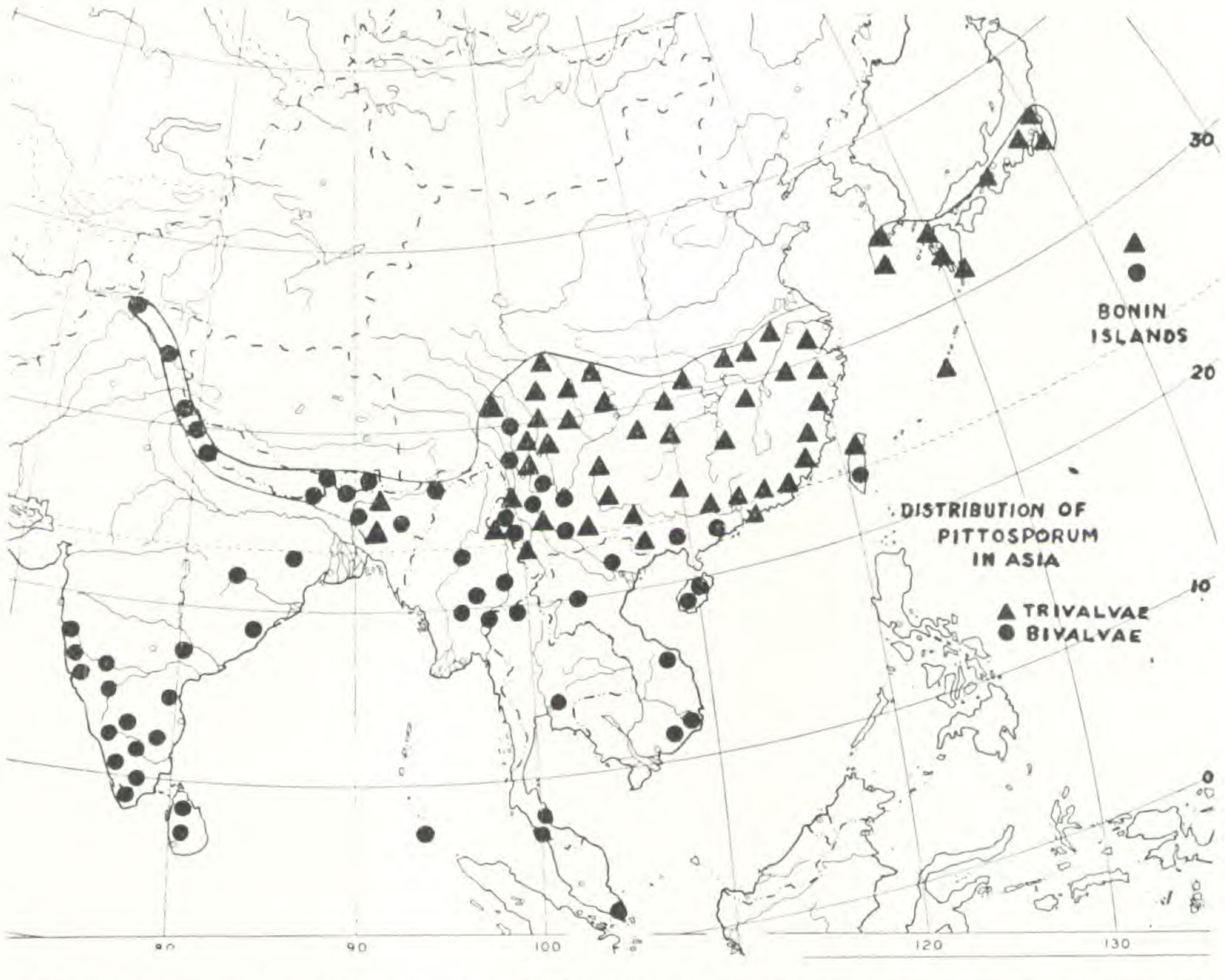
There are five species known from Formosa. *Pittosporum viburnifolium* is endemic to the island; *P. makinoi*, another endemic, very closely resembles *P. tobira*; *P. oligocarpum* occurs in China as well as in Formosa; *P. formosanum* and *P. daphniphylloides* both have their closest allies in China.

Over 60 per cent of the Asiatic *Pittospora* occur in continental China, in the Yangtze drainage and south of it. All the 14 species of the glabratum-complex except one (*P. podocarpum*) are confined there. The range of the individual species varies from local to widespread. *Pittosporum lignilobum* is localized in its distribution and occurs about Mt. Omei in Szechwan. *Pittosporum rehderianum* is known only from western Hupeh. *Pittosporum sahnianum* and *P. trigonocarpum* are widespread within China, while *P. podocarpum* extends from China to Assam in

India. The members of the BIVALVAE are concentrated in the western and southwestern parts of China. Some of the species found in Yunnan occur also in Assam, Burma, and Siam. For instance, *P. kerrii,* a species originally described from Siam, is very common in Yunnan, Burma, and Assam. The members of the balansae-complex, confined to Kwangsi and southwestern Kwangtung in China, occur in Hainan, Annam, Tonkin, and Upper Burma.

The distribution of the genus in India is restricted to two separate hilly areas. One is the Himalayas, from Assam through Bhotan, Sikkim and Nepal Garwhal to Rawalpindi in northwestern Punjab; and the other is the hills of the peninsula.

Pittosporum eriocarpum is endemic to western outer Himalaya and occurs up to 2200 m. altitude. The variety *P. napaulense* var. *rawalpindiense* is found as far as northwestern Punjab. *Pittosporum humile* is endemic to Assam. The species from Assam, in general, either occur also in the adjoining areas in Burma, Siam, and Yunnan or have the greatest resemblance to the species of these territories.



TEXT-FIGURE 4. Geographical distribution of the two major groups BIVALVAE and TRIVALVAE in Asia.

Five species are found in peninsular India. Of these only *P. dasycaulon* is endemic. It is confined to the Western Ghat-forests. *Pittosporum floribundum,* besides being common in South India, also occurs in Madagascar. *Pittosporum tetraspermum* occurs not only in South India and

Ceylon, but also from southwestern China. *Pittosporum ceylanicum*, once considered as endemic to Ceylon, occurs also in the Nilgiri Hills.

In summarizing the distribution of the genus in Asia, the following are interesting points:

1. The glabratum-complex and the tobira-complex of the TRIVALVAE are known only from the mainland of China, Formosa, the Ryu-Kyu and Bonin Islands, Japan, and South Korea. Only one of their members (*P. podocarpum*) extends into the Upper Burma-Assam territory from Yunnan. Isolated members of the TRIVALVAE occur in New Guinea, but they are not closely related to any of the Asiatic TRIVALVAE. Curiously, no species of TRIVALVAE seem to occur anywhere in the Philippines, Indonesia, Malaya, Indo-China, Siam, Lower Burma, South India, or Africa.

2. The members of the BIVALVAE not only range more widely in Asia than do the members of the TRIVALVAE, but also have more affinities outside the area. Most of the Asiatic species with bivalved small capsules have evident relation with the African species and with those of Malaysia. The close relationship between *P. kerrii* (Siam, China), *P. floribundum* (S. India, Madagascar) and *P. ripicola* (Central and East Africa) is especially noteworthy.

GROUPING

Putterlick, Synop. Pitt. 6–18 (1839), divided the genus into three subgenera, basing them on the kind and position of the inflorescences and the shape of the capsules. As has been mentioned, the inflorescences are very plastic, and no one kind is constant for any group of species in the genus, and this also is the case with regard to the shape of the capsules.

Carpel number, however, supplies a means of dividing the genus into two natural major groups. The species having two carpels are evidently a natural assemblage. They make up over 60 per cent of the representation of the genus in our area. Their carpel number is very constant. The other species usually have three carpels, but in some, occasional fruits on a plant may be aberrant in having only two or even as many as four or five carpels. Though not absolutely constant, three carpels is the prevailing and obviously basic number in this latter group. The name TRIVALVAE applied to it is appropriate. For the other group, species with only bicarpellate fruit, the name BIVALVAE is used. These may hold good for members of the genus in other areas also. Each group is further divided into species-complexes in our area.

KEY TO THE GROUPS AND SPECIES-COMPLEXES

a. Capsules usually 3-valved, occasional fruits rarely 4- or 5- or 2-valved.. .....Group I. TRIVALVAE.

b. Leaf-apex acute or acuminate; ovary glabrous or hairy; capsules mostly pyriform, or cylindrical, or ellipsoid, longer than broad (globular or subglobular in nos. 5 and 10); valves coriaceous, thin or woody; funicles long, slender, and flat, or short and peg-like. Confined to China except nos. 3, 12, and 13..A. Glabratum-complex.

bb. Leaf-apex obtuse or abruptly rounded, sometimes emarginate; ovary hairy; capsules globose or subglobose, rounded or angulate; valves woody; funicles short, peg-like. Korea, Japan, and Bonin Islands to Formosa and Coastal China,.....B. Tobira-complex.

aa. Capsules 2-valved.....Group II. BIVALVAE.

b. Capsules longer than broad, square or roundish in cross-section; seeds usually large, 5–6 mm. in diameter, roundish..... .....C. Balansae-complex.

bb. Capsules usually as long as broad, subglobose or roundish, 6–12 mm. in diameter; seeds small, usually irregular or somewhat reniform.

c. Valves woody; capsules usually large, 10–12 mm. in diameter; sepals usually 3–9 mm. long, acute to acuminate; flower-buds often ovate; ovary hairy.....D. Undulatum-complex.

cc. Valves thin; capsules usually small, 6–10 mm. in diameter; sepals usually 1–4 mm. long, rounded, obtuse or acute; flower-buds oblong; ovary glabrous or hairy..... .....E. Floribundum-complex.

KEY TO THE SPECIES

GROUP I. TRIVALVAE

A. Glabratum-complex:

a. Capsules broadest at or above middle, obovoid or pyriform or cylindric; stipe usually tapering, 0–5 mm. long; valves coriaceous or thin, creamy yellow inside; funicles slender, flat, 3–5 mm. long, yellowish, usually not imbedded in gummy secretion; seeds large, usually 5–8 mm. long, roundish or somewhat reniform, usually red to pink.

b. Leaves less than three times as long as broad, roundish obovate or broadly oblong.....1. *P. perryanum.*

bb. Leaves over three times as long as broad.

c. Ovary glabrous.....2. *P. glabratum.*

cc. Ovary hairy.

d. Funicles more than 3 on each placenta; seeds more than 8–12; leaves large, over 6–8 cm. long; capsules large, usually pear-shaped.....3. *P. podocarpum.*

dd. Funicles only 2–3 on the middle section of each placenta; seeds less than 8; leaves small, 2–4 cm. long; capsules small, cylindrical.....4. *P. kweichowense.*

aa. Capsules broadest at the middle, angular-ellipsoid, or globular; stipe absent or usually abruptly constricted; valves woody or thin, brown inside; funicles usually short, peg-like, darkish red, usually imbedded in the whitish gummy secretions; seeds small, irregular, darkish red.

b. Ovary glabrous; sepals slightly connate at base, glabrous, membranous, 1–2 mm. long, obtuse; petals 10–12 mm. long..... .....5. *P. rehderianum.*

bb. Ovary hairy.

c. Valves woody, up to 4 mm. thick; capsules large, 10–30 mm. long.

d. Sepals short, 2–3 mm. long, oblong-ovate, obtuse or rounded; capsules ellipsoidal.

e. Petals 9–11 mm. long; ovary 5 mm. long; capsules usually 15–20 mm. long; valves 3..6. *P. trigonocarpum.*
ee. Petals 12–14 mm. long; ovary 7 mm. long; capsules over 20 mm. long, often 35 mm. long; valves 3–5. . . . . .7. *P. lignilobum.*
dd. Sepals 7 mm. long, narrowly lanceolate, acuminate; capsules ovoid. . . . . .8. *P. subulisepalum.*
cc. Valves usually thin, up to 1 mm. thick; capsules 6–20 mm. long (capsules not seen in No. 9).
d. Petals 12–15 mm. long; pedicels usually equal to or slightly longer than the petioles. . . . . .9. *P. crispulum.*
dd. Petals less than 10 mm. long; pedicels longer than petioles.
e. Funicles 4 on each valve, slender, flat, in pairs on the middle section of the placenta..10. *P. kobuskianum.*
ee. Funicles more than 4 on each valve, short and peg-like, distributed along the placenta except at base and apex.
f. Pedicels long and slender, over 20–40 mm. long; fruits often pendulous.
g. Capsules extremely small (smallest in TRIVALVAE in Asiatic species), 6 mm. long, without abruptly constricted stipe; inflorescence a simple cyme; flowers small, petals usually 6–7 mm. long; pedicels extremely slender, less than 1 mm. thick. . . . . .11. *P. oligocarpum.*
gg. Capsules large, 10 mm. long; stipe abruptly constricted; inflorescence a cluster of single flowers; flowers large, petals usually 8 mm. long; pedicels more than 1 mm. thick. . . . . .12. *P. sahnianum.*
ff. Pedicels short, 10–12 mm. long; fruit usually erect.
g. Sepals connate at base, obtuse, 2–3 mm. long, unequal, ciliate; petals yellow. Japan. . . . . .13. *P. illicioides.*
gg. Sepals free, acuminate or acute, narrow-lanceolate, 4–5 mm. long, equal, non-ciliate; petals white. China. . . .14. *P. pauciflorum.*

B. Tobira-complex:

a. Valves usually 1–2 mm. thick; capsules angulate; flowers usually less than 10 mm. long (or in No. 15, sometimes as long as 13 mm.).
b. Inflorescences composed of cymose clusters; capsules large, over 10 mm. long.
c. Inflorescences very conspicuously tomentose; leaves obovate, broadest above middle and abruptly rounded at apex, frequently emarginate. Japan, Korea, China. . . . . .15. *P. tobira.*
cc. Inflorescences inconspicuously pilose; leaves obovate or obovate-elliptic, broadest at or above the middle, obtuse or rounded at apex. Formosa and Ryu-Kyu.

d. Petals 8–10 mm. long; sepals ovate, acute, equal and symmetrical; leaves usually obovate, broadest above middle, usually rounded at apex. Formosa.....16. *P. makinoi.*

dd. Petals 7–8 mm. long; sepals unequal, irregular in outline; leaves obovate-elliptic, broadest at or slightly above middle, obtuse at apex. Ryu-Kyu.....17. *P. lutchuense.*

bb. Inflorescences umbellate, glabrous, capsules 9 mm. in diameter. Fukien.....15B. *P. tobira* var. *fukienense.*

aa. Valves 3–4 mm. thick; capsules usually rounded (not seen in No. 15C); flowers usually large and over 10 mm. long (in No. 15C only 10 mm. long). Bonin Islands.

b. Flowers umbellate or solitary.....18. *P. parvifolium.*

bb. Flowers in cymose clusters.

c. Peduncles and pedicels glabrous; flowers 10 mm. long; leaves obovate-elliptic, obtuse at apex....15C. *P. tobira* var. *sakuraii.*

cc. Peduncles and pedicels usually pubescent; flowers over 10 mm. long; leaves obovate, rounded at apex.

d. Peduncles 20–35 mm. long; pedicels 5–20 mm. long.....19. *P. boninense.*

dd. Peduncles short, 10–25 mm. long; pedicels 40–60 mm. long.....20. *P. chichijimense.*

Group II. Bivalvae

C. Balansae-complex:

a. Large capsules, usually 2 cm. or more long, generally compressed, more or less square in cross-section.

b. Seeds 8 or fewer; flower-buds usually ovate; leaf-apex acute to acuminate; capsules often undulate due to depression between seeds; inflorescences densely tomentose with brown hairs; flowers sessile or short-pedicelled.

c. Leaves narrow-lanceolate, over four times as long as broad; flowers usually pedicellate.....21. *P. baileyanum.*

cc. Leaves elliptic or oblong, broader at or above middle, two or three times as long as broad; flowers sessile or short-pedicelled.

d. Leaves usually oblong to elliptic-oblong, broader just above middle, usually glabrous; sepals oblongish lanceolate, acute, 4 mm. long; flowers usually sessile and in fascicles; hairs silky, bright brown.....22. *P. confertum.*

dd. Leaves usually elliptic, broadest at middle, both ends acute, usually pubescent along the veins; sepals narrow-lanceolate, acuminate, 5–6 mm. long; flowers usually short-pedicellate; hairs blackish brown; sometimes leaf-apex acuminate....23. *P. balansae.*

bb. Seeds more than 8; leaf-apex rounded or long-acuminate.

c. Funicles short, peg-like, 1 mm. long, distributed in pairs from base to or beyond middle of the placenta; valves thick, reddish brown outside, pale brown inside; leaf-apex obtuse or rounded. Indo-China.....24. *P. gagnepainianum.*

cc. Funicles slender, flat, 2–3 mm. long, alternate along the whole length of the placenta; valves thin, yellowish outside, yellowish white inside; leaf-apex long-acuminate. Burma.....25. *P. chatterjeeanum.*

aa. Medium capsules, usually 10–15 mm. long, cylindrical or ellipsoidal, more or less circular in cross-section.

b. Funicles slender, flat, creamy yellow, 1–2 mm. long, 6–8 on each valve, distributed in pairs along the middle section of the placenta; capsules cylindrical, 14–15 mm. long. China.....26. *P. henryi.*

bb. Funicles knob-like, dark brown, short, 2 on each valve; capsules ellipsoidal 10–12 mm. long. Indo-China.

c. Leaves less than three times as long as broad, broadly elliptic, both ends acute; petioles short, 10 mm. long.....27. *P. merrillianum.*

cc. Leaves more than three times as long as broad, oblong or elliptic-oblong, petioles long, 15–25 mm. long.....27A. *P. merrillianum* var. *poilanei.*

D. Undulatum-complex:

a. Calyx 4–9 mm. long, sepals (or lobes) acuminate; flower-buds ovate except in No. 31.

b. Calyx densely tomentose.

c. Calyx up to 9 mm. long, united to form a long tube, the tube split into two parts, one 2-lobed, the other 3-lobed.....28. *P. undulatum.*

cc. Calyx up to 4 mm. long, sepals free, narrow-lanceolate.....29. *P. ferrugineum.*

bb. Calyx usually glabrous.

c. Sepals free, 4–5 mm. long. China.....30. *P. ovoideum.*

cc. Sepals connate at base, 7 mm. long. Bonin Islands.....31. *P. bicarpellatum.*

aa. Calyx usually less than 4 mm. long, sepals obtuse or acute; flower-buds oblong except in No. 36.

b. Leaf-apex obtuse or rounded.

c. Peduncles much shorter than leaves; petals large, 10–12 mm. long; inflorescence brown-tomentose. Formosa.....32. *P. viburnifolium.*

cc. Peduncles equal to or longer than leaves; petals smaller, 8 mm. long; inflorescence glabrous. Ceylon and South India.....33. *P. ceylanicum.*

bb. Leaf-apex acute to acuminate.

c. Leaves and young branches densely brown-tomentose; inflorescence densely brown-tomentose, flower-buds oblong.

d. Leaves elliptic, broader at middle; adult leaves usually glabrous; South India.....34. *P. dasycaulon.*

dd. Leaves usually broadly oblong, or elliptic-oblong, broader above middle; adult leaves tomentose on both the surfaces. Western Himalayas.....35. *P. eriocarpum.*

cc. Leaves and young branches glabrous; inflorescence usually glabrous; flower-buds ovate. South India..36. *P. neelgherrense.*

E. Floribundum-complex:

a. Ovary glabrous.
  b. Calyx cup-like, lobes very short and obtuse; inflorescences supra-axillary.....37. *P. nervosum.*
  bb. Calyx with sepals longer and free or only slightly connate at base, obtuse or acute; inflorescences terminal or axillary.
    c. Leaves broadly ovate to obovate. Formosa.....38. *P. formosanum.*
    cc. Leaves narrowly lanceolate. Assam.....39. *P. humile.*

aa. Ovary pubescent.
  b. Inflorescences profusely branched, terminal or pseudoterminal; leaves usually large, oblong, or obovate, or obovate-oblong.
    c. Inflorescences not compound umbellate.
      d. Inflorescences usually paniculate, not pyramidal, pubescent with whitish hairs.
        e. Seeds more than 4 per capsule; funicles basal to supra-basal. China and outer Himalayas.
          f. Petals 6–8 mm. long; leaves usually 4–12 cm. long, obovate, seeds 10 or more per capsule. China.....40. *P. brevicalyx.*
          ff. Petals 5–6 mm. long; leaves usually long, oblong or oblanceolate-oblong; seeds 4–8 per capsule. Outer Himalayas, North India.....41. *P. napaulense.*
        ee. Seeds usually 4 per capsule; funicles distinctly basal; leaves usually small, 6–12 cm. long, 2–4 cm. wide, often undulate towards margin. South India and Madagascar.....42. *P. floribundum.*
      dd. Inflorescences usually compound-corymbose, pyramidal; pubescent with brown hairs.
        e. Seeds 4 per capsule; funicles basal; sepals ovate, obtuse, membranous, ciliate. Siam, Burma, Assam and Southwest China.....43. *P. kerrii.*
        ee. Seeds 8–16 per capsule; funicles basal to infra-medial; sepals oblong, rounded at apex, non-membranous, non-ciliate.....38. *P. formosanum.*
    cc. Inflorescences usually compound-umbellate.
      d. Peduncles 20–30 mm. long; inflorescence loose; leaf-apex usually long-acuminate; leaves relatively small and narrow, 8–15 cm. long, 2–5 cm. wide, lanceolate or elliptic-lanceolate.....44. *P. johnstonianum.*
      dd. Peduncles 5–15 mm. long; inflorescence compact; leaf-apex acute; leaves usually large and broad, 10–35 cm. long, 5–8 cm. wide, broadly elliptic.
        e. Leaves large, often 35 cm. long (usually 15–19 cm. long); petioles stout and long, 2–4 cm. long. China.....45. *P. adaphniphylloides.*
        ee. Leaves relatively smaller, usually 10–16 cm. long; petioles short, 1–2 cm. long. Formosa.....46. *P. daphniphylloides.*

bb. Inflorescences simply umbellate, or subumbellate or single-flowered, pseudoterminal (in No. 51 corymbose-like and terminal); leaves ovate or narrow-lanceolate.
c. Leaves obovate, elliptic or elliptic-ovate.
d. Seeds only 4 per capsule; funicles basal; leaves elliptic to obovate. South India, Indo-China and China.....47. *P. tetraspermum.*
dd. Seeds more than 4 per capsule; funicles distributed from base to middle of the placenta.
e. Sepals 4–5 mm. long; inflorescences few-flowered or single-flowered; leaves elliptic, acuminate.....48. *P. leptosepalum.*
ee. Sepals less than 4 mm. long; inflorescences many-flowered; leaves obovate, abruptly acute.....49. *P. truncatum.*
cc. Leaves narrow-lanceolate.
d. Leaves 10–19 cm. long, strap-shaped or narrow-lanceolate, apex acuminate or acute, but not apiculate; petals 14 mm. long. Indo-China.....50. *P. oblongilimbum.*
dd. Leaves less than 10 cm. long, extremely narrow, heteromorphous, apex apiculate; petals less than 11 mm. long.
e. Inflorescences usually corymbose, terminal; seeds 10–14. Indo-China.....51. *P. pulchrum.*
ee. Inflorescences umbellate, or subumbellate or single-flowered. China.
f. Leaves of two types on the plant, narrow-lanceolate to oblanceolate, and obovate; seeds 5–8.....52. *P. heterophyllum.*
ff. Leaves extremely small and narrow, 20–35 mm. long, 3–9 mm. wide; subsessile..53. *P. saxicola.*

1. **Pittosporum perryanum** sp. nov.

Frutex 1 m. altus; foliis obovatis vel obovato-oblongis 8–17 cm. longis 4–6 cm. latis firmiter coriaceis glabris, apice plus minusve abrupte acutis, subtus areolis conspicuis laxis angulatis evidenter donatis; petiolo brunneo 5–15 mm. longo; floribus ignotis; capsula solitaria subcylindrica 18–25 mm. longa 12–15 mm. crassa, crasse 10–14 mm. longe pedicellata; valvis 3 firme coriaceis in ambitu late oblongis; funiculis 2–3 mm. longis gracilibus compressis placenta, usque ad 5–6 mm. supra basim sterili alibi fertili; seminibus 12 vel plus, 6–7 mm. longis, rubris.

Broad-leaved shrub, 1 m. tall; branching verticillate or forking; bark greyish brown; lenticels inconspicuous; leaves loosely crowded at forking and towards the ends of branches, blades roundish obovate to obovate-oblong, firmly coriaceous, glabrous, 8–17 cm. long, 5–6 cm. wide, veins on lower face prolonging to form submarginal vein, areolae conspicuous, large, polyhedral, clearly visible on the lower face, apex somewhat abruptly acute, margin entire, slightly recurved, petioles dark brown 5–15 mm. long; flowers not seen; capsules somewhat cyclindrical, green or brown, 18–25 mm. long, 12–15 mm. thick, 3-valved, borne singly on a short

stout fruit-stalk 10–14 mm. long; valves thin, less than 1 mm. thick, firmly coriaceous, broadly oblong in outline, inside creamy or brownish; funicles 2–3 mm. long, alternate or in pairs, distributed from 5–6 mm. above the base of the placenta, the base 5–6 mm. long, infertile; seeds over 12 per capsule, large, 6–7 mm. long, red.

Known from West Kwangtung, Kwangsi and Yunnan.

KWANGTUNG: Sup Man Ta Shan, *Liang 69823* (TYPE, A).

KWANGSI: Tsin Hung Shan, N. Hin Yen, alt. 1500 m., *Ching 7005* (A).

YUNNAN: s. l., *Wang & Liu 85091* (A).

Pittosporum perryanum is closely allied to *P. glabratum* and *P. podocarpum*, but differs from them in the shape and size of its leaves and capsules. Moreover, the areolae on the lower face of the leaves are readily visible to the naked eye, and they are large as compared to those of the other members of TRIVALVAE.

It is a pleasure to associate the name of this species with that of Dr. Lily M. Perry, in recognition of her work on the genus.

2. **Pittosporum glabratum** Lindley, Jour. Hort. Soc. London **1:** 230 (1846). — Based on a plant collected by Fortune at Hongkong, and cultivated in the Horticultural Society Garden, London, England.

Pittosporum Fortunei Turcz., Bull. Soc. Nat. Moscow **36:** 562 (1863); Bretschneider, Hist. Europ. Bot. Disc. China 434 (1898). — Based on a collection by Fortune from Hongkong.

Shrubs 1–2 m. tall; bark grey or greyish green; young branches brownish and dotted with lenticels; reduced leaves bract-like on long shoots and pilose with brownish hairs; leaves crowded towards the ends of branches, petioles 5–10 mm. long, blades coriaceous, glabrous, deep green or lustrous green above, pale green below, broadly elliptic or oblanceolate, 4–12 cm. long, 1.5–4 cm. wide, apex acute to acuminate, margin entire, slightly recurved; inflorescences pseudoterminal, slightly pubescent, umbellate or single-flowered, bracteate at base; bracts and bractlets mostly pilose with brownish soft silky hairs, margin densely ciliate; pedicels pilose, bracteate at base; flowers fragrant, polygamo-dioecious, short-stamened flowers usually solitary, long-stamened flowers in umbel; sepals free or slightly connate at base, densely ciliate, oblong or ovate or lanceolate, 1–3 mm. long. Short-stamened flowers: flowers robust, 8–10 mm. long; sepals early deciduous; corolla large, 9–12 mm. long; stamens short, appressed to but not surpassing the body of the ovary, anthers poorly developed, abortive, sagittiform; ovary well developed, glabrous, obovoid or pyriform with base tapering into stipe; style short, stigma capitate, rarely 3-lobed. Long-stamened flowers: usually umbellate; pedicels 3–10 mm. long; flower-buds slender 6–9 mm. long; corolla 7–10 mm. long, often slightly united at base, lobes reflexed after opening; stamens well-developed and as long as the corolla tube, reaching stigma, and bearing full-sized oblong anthers; ovary glabrous, somewhat cylindrical, gradu-

ally tapering into style; style glabrous; stigma capitate. Capsules 2–2.5 cm. long, 3-valved, pyriform with tapering stipe, greenish yellow; stipe 3–5 mm. long; fruit-stalk 3–10 mm. long; valves coriaceous, inner surface creamy yellow; funicles slender, flat, 3–5 mm. long, alternate, distributed along the whole length of the placenta; seeds large, roundish, 7 × 5 mm., pink or red.

HONGKONG: Wong Nei Chong Gap, *Tsiang 278* (A); Tseh Kou Yeu Shan, *Tsiang 92* (A); Lu Kai Dau Peak, *Tsiang 249* (A); Kwan Ying Temple, *Chun 4789* (A); s. l., *Chun 5189* (A); Castle Peak Monastery and vicinity, *Taam 1132* (A); Shek-O, *Taam 1901* (A); between Wanchai Gap and Wongneicheong Gap, March 28, 1919, *Swingle s. n.* (A); s. l., *Wright 26* (GH); *Lamont 28* (A).

KWANGTUNG: Kwai Shan, *Tsang 28522, 28633* (A); Joi Pe Loh, Kau Lung Fung, *Tsang 20011* (A); Tai Mo Shan, *Tsang 21079* (A); Sam Kok Shan, *Tsang 24852* (A); Tsing Wan Shan, *Lau 2255* (A); Pan Ling Tsze, *Chun 5878* (A); Ting Wu Shan, *Chun 6471* (A); Canton, alt. 800 m., *Handel-Mazzetti 653* (A); Ting Wu Shan, *Tsiang 759, 797* (A); Kwang Tso Kong, *Tsiang 176* (A); Lo Fou Shan, alt. 245 m., *Tsiang 1726, 1736* (A); same locality, *Ford 592* (A).

This plant is said to flower early in the spring and to bear pale greenish white and very sweet scented flowers.

In 1845, a living plant was sent from Hongkong by Fortune to the Royal Horticultural Society Garden, London. It was described by Lindley in 1846 as *P. glabratum*. His description was very meagre and incomplete, and the species has remained confused and poorly understood. Hooker, Fl. Brit. India 1: 198 (1872) identified it with Indian material. Later many more Chinese collections were assigned to the species. The distribution of *P. glabratum* was usually stated to cover the whole of China and North India.

What past botanists accepted as a single variable species is, in fact, a complex of species. In this paper it is treated as the glabratum-complex of TRIVALVAE. It includes, in addition to *P. glabratum*, about 14 species and two varieties. Typical *P. glabratum* is confined to Hongkong and Kwangtung and is readily distinguishable from other members of the complex by its completely glabrous ovary and pyriform capsule.

The flowers are markedly dimorphic. Normal hermaphrodite flowers, with slender cyclindrical ovary and well-developed stamens, are borne usually in clusters. Their anthers reach the level of the stigma or project slightly beyond. The short-stamened flowers show marked structural differences. They are robust, usually solitary flowers with a plump fertile ovary, and bear only short stamens with abortive anthers.

The specimens with solitary short-stamened flowers may appear to be different from those with clustered long-stamened flowers, but the glabrous ovary, the obovoid or pyriform capsules, and the general appearance of the plant give safe guidance for the ready recognition of the species.

By restricting *P. glabratum* to Hongkong and Kwangtung plants, with

a glabrous ovary, *P. podocarpum* becomes a clear-cut species easily recognizable by its hairy ovary. Fortunately there appears to be no intergradation between these two species in this particular feature. For all practical purposes they are satisfactory species.

2A. **Pittosporum glabratum** var. **neriifolium** Rehder & Wilson, Pl. Wils. **3:** 328 (1916). — Type: western Hupeh, Patung Hsien, *Wilson 3181.* Shrub 1–2 m. tall; leaves narrowly lanceolate, usually 10–15 (rarely 20) cm. long, 1–2.7 cm. wide, broader at or below the middle, glabrous, coriaceous; glabrous ovary.

Known from Western Hupeh and Szechwan, south to Hunan, Kiangsi, Kweichow and Kwangtung.

WESTERN HUPEH: Patung Hsien, alt. 1000 m., *Wilson 361, 3181* (A); Chienshih Hsien, *Chow 1187* (A); Kwan Ying Tong, alt. 1300 m., *Chun 3664* (A); s. l., *Henry 5422* (GH).

SZECHWAN: Kuan Hsien, alt. 1000 m., *Fan* and others *58* (A).

KWEICHOW: Huang Chia Wan, alt. 1400 m., *Steward, Chiao & Cheo 718* (A).

HUNAN: Ma Ling Tung, alt. 600 m., *Li 486* (A); Yun Shan, *Handel-Mazzetti 12150* (A).

KIANGSI: An Fu Woo, King Shan, alt. 1600 m., *Hu 719* (A).

KWANGTUNG: Samkok Shan, *Tsang 24944* (A).

HONGKONG: Hongkong woods, *Tutcher 9501* (A).

This variety differs from the species only in the form and size of the leaves. The leaves are very narrowly lanceolate, usually over six times as long as broad. This form and size are constant in most specimens. There are, however, a few intergrading specimens which could be placed either in the species or in the variety.

3. **Pittosporum podocarpum** Gagnepain, Not. Syst. **8:** 211 (1939).

Pittosporum glabratum sensu Hooker, Fl. Brit. Ind. **1:** 198 (1872), as to plants of India.

Pittosporum glabratum var. *ciliicalyx* Franchet, Bull. Soc. Bot. France **33:** 414 (1886). — Type: Yunnan, Tchen-Fong-Chan, *Delavay 183.*

Pittosporum glabratum var. *angustifolium* Pritzel in Diels, Bot. Jahrb. **29:** 378 (1900), *nomen nudum, Bock v. Rosthorn 3146* from "Tsou Ma Ling Kuan Hsien."

Pittosporum glabratum var. *chinense* Pampanini, Nuov. Giorn. Bot. Ital. n. ser. **17:** 285 (1910). — "Types" *Silvestri 873–876,* from Hupeh.

Shrub 1–3 m. tall; branches forking or verticillate; leaves crowded at the forks and towards the ends of branches, petioles 5–15 mm. long, blades thin-coriaceous, glabrous, oblanceolate to elliptic, usually 6–13 cm. long, 2–3.5 cm. wide, rarely 14 cm. long, 4 cm. wide, apex acute to acuminate, margin entire, slightly recurved; inflorescences umbellate to subumbellate or single-flowered, glabrescent to densely hairy, pseudoterminal, or after the development of an adjacent shoot, apparently lateral; pedicels 10–15 (rarely –20) mm. long; bracts and bractlets glabrescent or densely hairy; flowers polygamo-dioecious, 8–15 mm. long; sepals free or slightly con-

nate at base, 1–3 mm. long, ovate or irregular, membranous, usually ciliate. Short-stamened flowers: usually solitary; petals 8–15 mm. long; filaments 3–6 mm. long; anthers sagittiform, usually shrivelled and poorly developed; ovary plump, well developed, densely covered with light brown hairs; style glabrous 3–4 mm. long; stigma more or less capitate; fruit as in long-stamened flower. Long-stamened flower: flowers usually umbellate to subumbellate; petals 8–12 mm. long; filaments 8–9 mm. long, anthers somewhat oblong, well developed; ovary cylindrical, densely covered with light brown hairs; style glabrous, 3–5 mm. long; stigma pointed. Capsules usually solitary or in clusters of 2 or 3, borne on fruit-stalk 8–20 mm. long, pyriform, 2–3 cm. long, 1–1.5 cm. thick, 3-valved; valves coriaceous, obovate in outline, inside creamy, usually wrinkled or striate; funicles slender, flat, 3–4 mm. long, alternate along the whole length of the placenta; seeds usually large, 7 × 5 mm., roundish, red.

An extremely variable species and very widely distributed, ranging from China and the hilly forests of Assam south into Burma and Indo-China. It is common in Yunnan and Szechwan.

SZECHWAN: Mt. Omei, alt. 550–2500 m., *Yü 190, 237, 446* (A); *Wilson 583, 4744* (A); *Liu 1468, 1721, 1824* (A); *Fan 810* (A); *Yin 237* (A); *Sun & Chang 1255* (A); Sung Pan Hsien, *Fang 6033* (A); Huayenting, alt. 1600 m., *Chow 9766* (A); Chutien, alt. 1760 m., *Chow 9941* (A); Kuan-hsin-po, alt. 1200 m., *Sun & Chang 1458* (A); Tsuan-tien-po, alt. 2000 m., *Sun & Chang 896* (A); Niu-hsin-ssu, alt. 850 m., *Tai 463* (A); Wuan-hsin-po, alt. 1200 m., *Tai 1055* (A).

HUPEH: Lungo, *Silvestri 874–876* (A); N. Tan-sien, *Silvestri 4131* (A); s. l., *Wilson 657, 3414, 7850A* (A, GH).

KWEICHOW: Liang Feng Yah, *Steward, Chiao & Cheo 144* (A); Ta-chon, Tsingchen, *Teng 90123* (A).

KWANGSI: Loh Hoh Tsuen, Ling Yün Hsien, alt. 1900 m., *Cheo 142* (A); Chen Pien, *Ko 56102* (A); Ling Wan, *Lau 28743* (A).

INDO-CHINA: Tonkin, *Poilane 12815* (A).

YUNNAN: Mienning, Poshang, *Yü 18057* (A); Yuanchey, alt. 1600 m., *Henry 13403* (A); Mengtze, N. Mt., alt. 2000–3000 m., *Henry 10191A, 10551, 10553* (A); Pin Tshouan, *Ducloux 530, 6709* (A, NY); Lan Tsang Hsien, alt. 2200 m., *Wang 76796* (A); Chui Pien Hsien, alt. 1300 m., *Tsai 51404* (A); Ping Pien Hsien, alt. 1500 m., *Tsai 62676* (A); Chen-hsuing Hsien, alt. 1200 m., *Tsai 52228* (A); Kuyung, *Rock 7552* (A); Che-Kio-Chan, alt. 2600 m., *Marie 512* (A); around Pe Yen Tsin, *Ten 603* (A); Tchen Fong Chan, *Delavay 183* (A, phot.).

BURMA: Hills between Mong Kai and Mong Wa, *Ward 8825* (A); Pumpri Bum, alt. 1800 m., *Wood s. n.* (C).

INDIA: Assam, Shillong, alt. 2000 m., *Ruse 55* (A); Jowai Road, 1892, *Prain s. n.* (C); alt. 1300 m., *King s. n.* (C); Manipur, *Watt s. n.* (A, C); Chingson, alt. 2000 m., *Watt 5908* (C); Khasia Hills; alt. 1000–1800 m., *Kurz 215* (C), *391* (A, C); alt. 1600 m., *Clarke 14860, 18723, 43639* (C); *Mann s. n.* (C); *Oldham 8* (C); alt. 1300 m., *Hooker & Thomson s. n.* (C); *S & Kg 734* (C). Naga Hills, Iapoo (C); Konoma, *Watt 11531* (C); Mawphlang, *Carter 1189, 1605* (C).

It is evident that Franchet's varietal name, Pampanini's varietal name, and Gagnepain's name were all proposed for one form or another of the same species. The authors were probably unaware of its dimorphic flowers and the variation in form of its inflorescence.

The following details concerning floral variation merit some discussion. The specimen *Yü 237* bears short-stamened flowers in umbellate cluster; *Yü 190* bears long-stamened flowers in umbellate cluster. The cluster and flowers in these two specimens are similar except for the slight differences in the ovary and in the length of the filaments. *Henry 10553* has long- and short-stamened flowers. The ones with short stamens are solitary and larger, whereas those with long stamens are in clusters and somewhat smaller. *Ducloux 6709* bears only short-stamened flowers, which are solitary and unusually large. These flowers are nearly twice as large as any long-stamened flowers observed in the species. Here the ovary is plump and well developed; the filaments are short and do not surpass the body of the ovary; the anthers are almost abortive. In fact, this species exhibits a gradual shortening of stamens from 8–9 mm. long to 3–4 mm. long and illustrates the accompanying correlations; the gradual reduction of anthers from a well developed to an almost abortive condition; the gradual transformation of hermaphrodite flower to functional unisexuality; and the reduction of many-flowered inflorescences to single-flowered ones.

In spite of such variations the species is distinctive in (a) its pubescent ovary, (b) its obovoid or pyriform capsule, (c) its coriaceous valve, (d) its long, slender, flat funicles, 3–4 mm. long, and (e) its large red seed.

It is very closely allied to *P. glabratum* and distinguished from the latter mainly by its pubescent ovary and by its geographical area.

3A. **Pittosporum podocarpum** var. **angustatum** var. nov.

Foliis anguste lanceolatis 8–16 cm. longis, 1–2 cm. latis; floribus polygamo-dioicis; ovario pubescente.

Leaves narrow-lanceolate, 8–16 cm. long, 1–2 cm. wide (occasionally 3 cm. wide at middle) broadest at the middle, glabrous, coriaceous; ovary pubescent.

This variety follows the range of the species in its distribution.

SZECHWAN: Mt. Omei, alt. 1500 m., *Yü 450* (A), *Fang 3059* (A); Yalung, Yenyuen, alt. 2700 m., *Handel-Mazzetti 2613* (A); O-Pien Hsien, alt. 2200 m., *Yü 637* (A); Kuan Hsien, alt. 1000–1200 m., *Fang 2190* (A); Mt. No-Mi-San, 1899, *Hugh s. n.* (A); Ping-Shan Hsien, alt. 1800 m., *Wang 22751* (A); s. l., *Wilson 3231, 3231a* (A).

HUPEH: Ichang, alt. 1000 m., *Wilson 657* (A); s. l., *Henry 7850a* (A).

KWANGSI: Chuen Yuen, alt. 1100 m., *Chung 83304* (A).

YUNNAN: Mengtze, N. mount. forests, alt. 7000 ft., *Henry 10545* (TYPE, A) (shrub, 5–6 ft., yellow flowers); same locality, alt. 5000 ft., *Henry 10191B* (A); Yuanchey, alt. 6000 ft., *Henry 13299* (A); Wen-Shan Hsien, alt. 1800 m., *Tsai 51717* (A); Chiu-Pei Hsien, alt. 1800 m., *Tsai 51415* (A); Ping-Pien Hsien, alt. 1500 m., *Tsai 61783, 62787* (A); s. l., *Tsai 52004, 55686, 56000* (A); Mienning, alt. 2350 m., *Yü 18081* (A); Tsang-Yuan, alt. 1500 m., *Wang 73279* (A).

BURMA: Myitkyina, Kangfang-Pawte Road, alt. 2000 m., *Kermode 17290* (Dehra Dun Herb.) (shrub, 3 ft. high, flowers yellow, scented).
INDIA: Assam: Manipur, *Watt 6538* (C); Japvo, *Watt 11453* (C); Kohima, *Watt 11612* (C); Kononur, alt. 1300 m., *King 212* (C); Khasia Hills, Sibpur Bot. Gard. Herb. *34133* (C); Shillong Peak, alt. 2100 m., *Kanjilal 2312* (C).

This variety differs from the species only in the form and size of its leaves. A parallel to this is found in *P. glabratum* and its variety.

4. **Pittosporum kweichowense** sp. nov.

Frutex; ramulis apicem versus pubescentibus; foliis 2–4 cm. longis 1–1.5 cm. latis, ellipticis vel elliptico-lanceolatis firmiter coriaceis glabris, apice acutis vel obtusis apiculatisque; floribus ignotis; capsula cylindrica 12–15 mm. longa; valvis 3 rigidis 1 mm. crassis oblongo-ellipticis; placenta in parte media 2–4 mm. longa fertili funiculis 2–3 alternatis compressis 2–4 mm. longis gracilibus donata; seminibus 4–5 mm. diametro rubris.

Shrub; branches 2–3 at each forking; branches towards the ends pubescent with short appressed rusty hairs; bark whitish grey; lenticels whitish or brown dot-like specks; leaves usually crowded towards the ends of branches, blades small, elliptic or elliptic-lanceolate, firmly coriaceous, glabrous, deep green above, pale green below, 2–4 cm. long, 1–1.5 cm. wide, the midrib occasionally dividing the blade unequally, apex acute to obtuse and apiculate, margin entire, petioles 0–2 mm. long; flowers not seen; capsules cylindrical, yellowish brown, 12–15 mm. long, surface nearly smooth, fruit-stalk short, thick, 3–4 mm. long, with collar-like arrangement of minute bud-scales persisting at the base; valves usually 3, less than 1 mm. thick, stiff, oblongish elliptic in outline, outer surface yellowish brown, inner surface creamy yellow and inconspicuously striate; funicles 2 or 3 on each valve, alternate on the middle section of the placenta, 2–4 mm. long, slender, flat; seeds large, 5–6 mm. in diameter, roundish, bright red. Known from southernmost Kweichow.

KWEICHOW: Near Anlung, alt. 500 m., in lightwood forests, *Tsiang 7444* (TYPE, NY) (shrub; leaves lustrous deep green above and light green below; fruits yellow when fresh; seeds red).

In its leaf and capsule, *P. kweichowense* is so distinct that it cannot be referred to any known members of TRIVALVAE in our area. However, in its 3-valved capsules, slender flat funicles, and round red seeds, it somewhat resembles *P. glabratum* and its relatives. It also bears resemblance to some of the members of BIVALVAE. Especially in the shape and size of its capsules its looks somewhat like *P. henryi*. I have included this new species under TRIVALVAE on the basis of the number of valves in the capsule.

Distinctive of the species are the following characters: (a) the cylindrical 3-valved small yellowish capsules; (b) the two or three slender, flat funicles borne on the middle section of each placenta; (c) the large (6 × 5 mm.) seeds; and (d) the small (2–4 cm. long, 1–1.5 cm. wide) elliptic-lanceolate leaves.

5. **Pittosporum rehderianum** sp. nov.

Frutex 1–3 m. alta; foliis oblanceolatis vel obovatis 6–15 cm. longis 2–4.5 cm. latis glabris coriaceis, apice acutis vel acuminatis; inflorescentia pseudoterminali subumbellata glabra; floribus in alabastro 8–10 mm. longis; sepalis inaequalibus 1–2 mm. longis membranaceis glabris late ovatis obtusis vel rotundis; petalis 10–12 mm. longis; ovario glabro; capsulis subglobosis 2 cm. longis lignosis angulatis; valvis 3 late ellipticis 1–2 mm. crassis; placenta basi usque ad apicem fertili funiculis brunneis brevibus rigidis biseriatis donata; seminibus numerosis parvis irregularibus.

Shrub 1–3 m. tall; branching verticillate or forking; bark yellow or brownish grey, speckled with lenticels; leaf-scars conspicuous at the forking of the branches; leaves usually crowded at forking and towards the ends of branches, glabrous, coriaceous, blades occasionally wavy towards the margin, 6–15 cm. long, 2–4.5 cm. wide, oblanceolate or obovate, apex acute to acuminate, margin entire and slightly recurved, petioles 5–15 mm. long; inflorescences pseudo-terminal, subumbellate, glabrous, bracteate at base; bracts and bractlets membranous, whitish brown, very small, oblongish or ovate, 1–4 mm. long, glabrous; pedicels 5–10 mm. long; flower buds oblong, 8–10 mm. long; sepals unequal, 1–2 mm. long, slightly connate at base, membranous, glabrous, broadly ovate, obtuse or rounded, margin thin, whitish; petals yellow, free, 10–12 mm. long; filaments 6–7 mm. long; anthers 2 mm. long; ovary glabrous, 4 mm. long; style glabrous 5 mm. long; stigma slightly capitate; capsules subglobose, 2 cm. long, woody, angulate, 3-valved; fruit-stalk short and stout, 10–20 mm. long; valves broadly elliptic in outline, usually 1–2 mm. thick, woody; funicles peg-like, small, darkish, in two rows, all along the well-marked placental ridge; seeds many, small, irregular, darkish red.

An inland species, known from southern Shensi, Szechwan, and western Hupeh.

SHENSI: Chui-kis-tsuen, Sept. 25, 1897, *Giraldi* (TYPE, A); s. l., *Wilson 886* (A).

SZECHWAN: Chengtu and vicinity, *Fang 12144* (A).

HUPEH: Patung Hsien, alt. 1000 m., *Wilson 3180* (A); s. l., *Wilson 279a, 583a* (A); s. l., *Henry 3387a, 4369, 5999* (A, GH); Enshih Hsien, *Chow 1942* (A); Ching-pin-chang, alt. 660 m., *Chun 3599* (A); Liang-sung-yon, alt. 930 m., *Chun 3841* (A); Hankow, *Chun 3773, 3600* (A).

Rehder and Wilson, Pl. Wils. 3: 327 (1916), referred some of the cited material to *P. glabratum*. The flower, bract, and bractlet of this species, however, resemble more closely those of *P. lignilobum* and *P. trigonocarpum*. From these it differs in its glabrous ovary and subglobose capsule. Though having the glabrous ovary of *P. glabratum* and *P. glabratum* var. *neriifolium*, it differs from them in its angulate subglobular capsules, in its peg-like funicles, in its glabrous inflorescences, bracts, and bractlets, and in its northern distribution.

6. **Pittosporum trigonocarpum** Léveillé, Fedde Repert. Spec. Nov. **11**: 492 (1913). — Type: Kweichow, Tin-Fan, *J. Cavalerie 1857*.

Pittosporum xylocarpum Hu & Wang, Bull. Fan Mem. Inst. Biol. n. ser. **1**: 95 (1941). — "Types": Szechwan, Mt. Omei, *W. P. Fang 13754, 14048*.

Pittosporum glabratum sensu Rehder, Jour. Arnold Arb. **12**: 280 (1931).

Shrub or small tree, 2–5 m. tall; branching usually verticillate; bark greyish or darkish brown, speckled with lenticels; leaves glabrous, alternate along the branches, becoming loosely verticillate towards the ends, blades occasionally wavy towards the margin, 5–15 cm. long, 2–5 cm. wide, oblanceolate or broadly oblanceolate with acute base, apex acuminate or acute, margin entire, slightly recurved, petioles 5–15 mm. long; inflorescences pseudoterminal, umbellate or subumbellate, glabrous, subtended by a whorl of young leaves and bracts; bracts narrow-lanceolate; flowers fragrant; flower-buds oblong; pedicels 1–2 cm. long, erect, glabrous; sepals ovate, unequal, 2–3 mm. long, obtuse or rounded, glabrous, slightly ciliate; petals yellow, 9–11 mm. long; filaments 6–7 mm. long; anthers sagittate, 2 mm. long; ovary covered with silky whitish brown hairs, obovoid or globular; style glabrous, 3–5 mm. long; stigma pointed; capsules ellipsoid, 3-angled, 15–20 mm. long, 9–10 mm. thick, 3-valved; fruit-stalk 10–25 mm. long, usually erect; valves woody, 1.5–2 mm. thick, elliptic in outline; funicles short, peg-like, biseriate, distributed along the placenta from just above the base to beyond the middle of the placenta, the base and apex of the placenta on the valve infertile; seeds small, many, 3–4 mm. long, darkish red, irregular.

Pittosporum trigonocarpum is widely distributed in China, ranging from Sikong through Szechwan, Hupeh, Kweichow, and Kwangsi to Chekiang. It extends north to southern Shensi. However, it has been most collected in western Szechwan (about Mt. Omei and the adjoining border near Yaan in Sikong) and western Hupeh. Southern Shensi in Central China is the northernmost limit reached by any of our species of *Pittosporum*.

SIKONG: 5 miles from Yaan, near suspension bridge, alt. 600 m., *Chiao 1151* (A); Moon-ting Shan, alt. 1400 m., *Chiao 1308* (A).

SZECHWAN: Mt. Omei: alt. 475 m., *Fang 14048, 14242, 15356* (A); alt. 700–1000 m., *Liu 2138* (A); *Chiao & Fou 58* (A); alt. 1000 m., *Wang 23501* (A); Kuan-hsien, alt. 1000–1200 m., *Fang 1999* (A); Chen-kou-hsien, *Fang 9991* (A); Kikiang Hsien, alt. 1200–1500 m., *Fang 1331* (A); Chung Hsien, *Fang 469* (A); Mt. Kou-hsien, alt. 600–1300 m., *Liu 1844* (A); Nanchuan, *Bock v. Rosthorn 1933, 2074* (A); *Sun & Chang 600* (A); Taifussu, *Chow 9035* (A); Wuzussu, *Chow 9684* (A); Chutze-chang, *Chow 9425* (A); Hsinchang, *Chow 9531* (A); north of Chengtu plain, alt. 1200 m., *Wang 22159* (A); south of Kuan Hsien, alt. 970 m., *Wang 20486* (A); Ping Shan Hsien, alt. 1800 m., *Wang 22747* (A); Chengtu, *Chien 5921* (A); Chien Yang Hsien, *Chien 5248* (A); Kiating on the hill slope, *Tu 772* (A); same locality, *Sun & Chang 16* (A); in forests, alt. 350 m., *Tai 25* (A); near Kiatingfu, alt. 550 m., *Yü 185, 187* (A).

HUPEH: Gian Gior Kou, *Chun 3944* (A); Patung Hsien, alt. 1000 m., *Wilson 279, 456* (A); Ice fort, *Wilson 886* (A); s. l., *Wilson 456* (GH).
KWEICHOW: Tin-fan, *Cavalerie 1857* (A).
KWANGSI: Tou Ngok Shan, *Tsang 23149* (A).
CHEKIANG: Sui-an Hsien, alt. 660 m., *Hu 531* (A).

The differences in capsules and seeds pointed out by Hu & Wang for distinguishing *P. xylocarpum* are those that characterize *P. trigonocarpum*. The species are obviously the same. Hu & Wang have probably overlooked *P. trigonocarpum*.

Pittosporum trigonocarpum is well characterized by its trigonal woody capsules with rough brown or blackish surface, and by its small seeds. It can easily be separated from *P. glabratum* by its hairy ovary. Its closest relative, however, is *P. sahnianum*, with which it intergrades in some characters. The two differ, however, in the size of flowers and capsules and in the length of pedicels, as well as in general appearance.

According to Hu & Wang, the species produces in the spring an abundance of fragrant yellow flowers. These are borne with evergreen foliage at the tips of the branches. Later in the year the abundant oily reddish seeds in the open capsules make an attractive display against the background of glossy bright green leaves.

7. **Pittosporum lignilobum** Hu & Wang, Bull. Fan Mem. Inst. Biol. n. ser. 1: 98 (1941). — "Types": Szechwan, Mt. Omei, *Fang 15503, 15504,* and *Sun 1692*.

Small tree or shrub, 2–4 m. tall; branching loosely verticillate or forking; bark grey or brown, speckled with lenticels; leaf-scars broadly reniform; leaves usually crowded towards the ends of branches, blades 9–15 cm. long, 2.5–5 cm. wide, obovate or oblanceolate to elliptic, coriaceous, glabrous, apex acuminate or acute, margin entire, slightly recurved, petioles 5–20 mm. long; inflorescences pseudoterminal, single-flowered or simply umbellate, glabrous; bracts glabrous, membranous, oblong, whitish brown, 4–5 mm. long; pedicels 5–25 mm. long; sepals 2–3 mm. long, glabrous, free or slightly connate at base, oblong-ovate, obtuse, membranous, occasionally ciliate; petals white or yellow, free, 12–14 mm. long; filaments 10 mm. long; anthers 2 mm. long; ovary hairy, 7 mm. long, cylindrical; style glabrous, 5 mm. long; stigma somewhat pointed; capsules ellipsoid, angular, 2–3.5 cm. long, 2 cm. thick, both ends acute or the apex acute and the base abruptly rounded; valves 3–5, usually 4 or 3, woody, 2–3 mm. thick; funicles biseriate, peg-like, reddish brown, 1–2 mm. long, many, distributed all along the well-raised placental ridge; seeds many (up to 46), small, irregular, darkish red.

Known only from Mt. Omei and its vicinity in West Szechwan and perhaps endemic there.

SZECHWAN: Mt. Omei: alt. 650–1760 m., *Fang 2517, 2598, 3387, 3390, 6161, 12651, 15017, 15392, 15503, 15504* (A); *Sun & Chang 454, 1634, 1731* (A); *Chow 4871, 7555, 8234, 8484, 8982, 9734* (A); *Lee 4512, 4531, 4546,*

4553 (A); *Tai 456, 460, 616* (A); *Chiao & Fan 179, 406* (A); *Liu 1604, 1720, 1822* (A); Uo-mi-san (Mt. Omei), 1899, *Fr. Hugh s. n.* (A); O-Pien-Hsien, alt. 1300–1800 m., *Liu 2167* (A).

Pittosporum lignilobum is noteworthy for its very large capsules. In maximum size, they are the largest developed by any of our species. The valves may become very thick, and may occur in number as high as five. No other Asiatic species has such coarse valves or produces then in such high numbers. Even the number of seeds produced (as high as 46) is greater than in other species in our area.

This is an interesting species. I have seen few flowering specimens. My description of the inflorescence and flower is based on *Chow 9734*, and supplemented from the original description. The species probably has dimorphic flowers, since this condition prevails in related species having capsules that are invariably solitary. Those who may have an opportunity to collect the plant should note floral dimorphism, if any.

8. **Pittosporum subulisepalum** Hu & Wang, Bull. Fan Mem. Inst. Biol. n. ser. 1: 100 (1941). — "Types," Hunan, without precise locality, *T. H. Chao* [*Choa*] *610, 5000*.

Leaves oblong-obovate, rarely obovate to oblong-elliptic, 4–11 cm. long, 1.5–4 cm. wide, apex acuminate to acute; inflorescences pseudoterminal, few-flowered (2–4 flowers), umbellate, glabrous; pedicels 6–10 mm. long; sepals free, linear-lanceolate, acuminate, 7 mm. long, ciliate; petals narrow, oblong, obtuse, 8.5–9 mm. long; filaments 2.5 mm. long; anthers sagittate, obtuse, 1.3 mm. long; ovary densely hairy, 3-carpelled, obovoid; ovules 16, 5 or 6 on each placenta; capsules ovoid, 3-valved; valves woody, 12 mm. long, 8 mm. wide.

Known from Hunan and Anhwei.

The short description given above has been adapted from the original of Hu & Wang. I have seen no plant recognizable as belonging to this species. According to Hu & Wang, its outstanding character is its long sepals. The latter are said to be linear-lanceolate and 7 mm. long. Such elongate sepals are really unique among the members of the TRIVALVAE. Of all the members of this group which I have examined, none have sepals longer than 4–5 mm. The long sepals combined with roundish ovoid 3-valved capsules are indeed distinctive features.

9. **Pittosporum crispulum** Gagnepain, Bull. Soc. Bot. France 55: 546 (1908). — Type: "Chine. — Yunnan: Ko-kouy, près Tchao-tong; plante cueillie par le P. Marc Mey, avril 1896, no. 4720 (*Ducloux*)."

Shrub 1–3 m. tall; branching verticillate or forking; bark on old branches brownish grey, speckled with lenticels, on young branches darkish brown without evident lenticels; leaves alternate along and loosely crowded towards the ends of the branches, blades 6–12 cm. long, 2–5 cm. wide, oblanceolate or obovate, broader at or above the middle, tapering towards base, coriaceous, glabrous, upper surface darkish brown, lower surface

light brown, apex acute, margin entire, slightly recurved, petioles 5–20 mm. long; inflorescences pseudoterminal, umbellate or subumbellate or single-flowered, pubescent with darkish or brown silky hairs or glabrous, subtended at base with bracts and leaves; pedicels equalling or slightly longer than subtending petioles; bracts narrowly lanceolate, glabrous; bractlets minute, inconspicuous, linear, 2–3 mm. long, slightly pubescent or glabrous; flowers polygamo-dioecius (*Tsai 55741*); sepals free or connate at base, glabrous or pubescent, 2–3 mm. long, ovate or lanceolate, acute, ciliate; petals yellow, 12–15 mm. long. Short-stamened flowers: solitary; filaments 5 mm. long, not surpassing the body of the ovary; anthers 1.5 mm. long, sagittiform, poorly developed; ovary 3-carpelled, ovoid, hairy, 6–7 mm. long; style glabrous, 5 mm. long; stigma capitate. Long-stamened flowers: umbellate or subumbellate; filaments 7–8 mm. long; anthers 2 mm. long, oblong, level with stigma; ovary cylindrical, hairy, 3-carpelled, 6 mm. long; style glabrous, 5 mm. long; stigma pointed. Capsules not seen.

Known from the upper Salween River Valley in western Yunnan.

YUNNAN: Lung-Ling Hsien, alt. 1800 m., *Tsai 55741* (A) (two twigs on the sheet, one with subumbellate inflorescence in which the flowers bear long stamens; the other single-flowered with the flowers bearing short stamens), and *Tsai 55602, 55697* (A); Yan Tsien Hsien, alt. 500 m., *Tsai 50806* (A); s. l., *Forrest 9856* (A) (this is densely tomentose and has larger flowers).

Distinctive of the species are its large flowers, usually 12–15 mm. long, and its limited distribution in the Salween River Valley in western Yunnan. Unfortunately neither Gagnepain nor I have seen fruits of any specimen referable to this species. Until these are known, the species must remain doubtful, since flower-size is not a very reliable character among the species with dimorphic flowers.

(*To be concluded*)

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MARI GOWDA

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10. **Pittosporum kobuskianum** sp. nov.

Frutex vel arbuscula 2–4 m. alta; foliis ellipticis vel obovatis 6–9 cm. longis 4–5 cm. latis tenuiter coriaceis glabris apice acutis vel acuminatis; inflorescentia pseudoterminali umbellata glabra pauciflora vel uniflora; sepalis glabris 2 mm. longis oblongis apice rotundatis; petalis 8 mm. longis; ovario pubescente; capsulis globosis 15–20 mm. diametro; valvis 3 late ellipticis 1 mm. crassis; placenta medium versus fertili funiculis 4 gracilibus compressis 1–2 mm. longis geminatis donata; seminibus 12 irregularibus 3–5 mm. longis.

Shrub or small tree, 2–4 m. tall, branching verticillate or forking; bark grey or brown; lenticels whitish dot-like specks; leaf scars small and crescent-shape along the branches, larger and reniform at forking of branches; leaves glabrous, usually crowded at the forking and towards the ends of the branches, blades elliptic to obovate, thin-coriaceous, 6–9 cm. long, 2–3 cm. wide, occasionally 10–12 cm. long, 4–5 cm. wide, apex acute to acuminate, margin entire, slightly recurved, petioles 10–15 mm. long; inflorescences pseudoterminal, single-flowered or few-flowered, simple umbellate, subtended by leaves and bracts at base; bracts small, scaly, early deciduous, glabrous; pedicels bracteate at base, slender, usually 1 cm. long, glabrous; sepals glabrous, usually 2 mm. long, oblongish, rounded at apex; petals 8 mm. long; filaments 6 mm. long; anthers 2 mm. long; ovary pubescent, ovoid, 2.5 mm. long; style glabrous 3.5 mm. long; capsules globular, 15–20 mm. in diameter, greenish or yellowish brown, 3-valved; fruit-stalk 10–20 mm. long; valves thin, less than 1 mm. thick, broadly elliptic in outline, inside striate, brownish; funicles slender, flat, 1–2 mm. long, 4 on each valve, arranged in pairs on the middle section of the placenta; seeds about 12 per capsule, irregular, 3–5 mm. long, blackish pink.

Known from Kwangsi, Kwangtung and Kweichow. It has been collected also from Mt. Omei in Szechwan.

KWANGTUNG: Hwan-kun, Lochong, alt. 460 m., *Tsiang Ying 1320* (TYPE, A).

KWANGSI: Liang-mao-shan, Pai-shou, *Taam 11* (A); Shuen-yuen, *Chung 81623* (A); Hang-on-yuen, *Chung 81787* (A); Hing-on, *Chung 83625* (A); Ta Tseh Tsuen, Yung Hsien, alt. 380 m., *Steward & Cheo 733* (A); Yao Shan, Tseugyuen, *Wang 39603* (A).

KWEICHOW: Liang Feng Yah, Tsunyi Hsien, *Steward, Chiao & Cheo 74* (A); Nandjing-shan, alt. 700 m., *Handel-Mazzetti 329* (A).

SZECHWAN: Mt. Omei, alt. 1000–1200 m., *Fang 2324, 2421* (A).

Pittosporum kobuskianum differs from all other members of the glabratum-complex in having globular capsules, and four funicles on each valve. The funicles are arranged in two pairs on the middle section of the placenta. The entire plant is glabrous except for the ovary. I have seen very few flowers and these are badly preserved.

This species is named in honor of Dr. C. E. Kobuski of the Arnold Arboretum, in recognition of the help and encouragement he has given me in my work.

11. **Pittosporum oligocarpum** Hayata, Jour. Coll. Sci. Tokyo 30: 35 (1911); Hayata, Icon. Pl. Formosa 1: 63 (1911); Kanehira, Formosan Trees 249, *f. 193* (1936). — Type: "Taito (no. 5837); Bioritsu, Bunsuikei."

Pittosporum oligospermum Hayata, Icon. Pl. Formosa **3:** 31 (1913); Hayata, Icon. Pl. Formosa **5:** 7, *f. 2* (1915). — Type: "Formosa: loco non indicato."

Evergreen shrub or small tree 2–8 m. tall; leaves usually crowded towards the ends of branches, blades 4–10 cm. long, 1–2.5 cm. wide, rather thin, glabrous, oblanceolate to obovate or elliptic, apex acute to acuminate, margin entire, slightly recurved, petioles 5–10 mm. long; inflorescences pseudoterminal, single-flowered or simple few-flowered cymes, glabrous, subtended by leaves at base; pedicels very slender, 2–3 cm. long, glabrous, darkish; flower-buds small, oblong, 5–6 mm. long; sepals 1–2 mm. long, glabrous, slightly connate at base; petals 6–7 mm. long; filaments 4 mm. long; anthers 1.5 mm. long; ovary hairy, ovoid; style glabrous, 2 mm. long; stigma capitate; capsules globose or subglobose, small, 7–9 mm. long, without or with inconspicuous stipe; fruit-stalk 2–3 cm. long, extremely slender; valves 3, somewhat thick, roundish elliptic in outline, inner surface striate; funicles very small, knob-like, distributed from just above the base to the middle of the placenta; seeds usually 6–8, small, irregular, darkish red.

Known from Formosa, also from Chekiang and Kwangsi on the Chinese mainland.

FORMOSA: mountainside, alt. 1300 m., *Gressitt 188* (A); Arisan kagi, *Wilson 9774* (A); Mt. Daibu, *Matuda 74* (A).

CHEKIANG: Wenchow, alt. 500 m., *Ching 1874* (A).

KWANGSI: Pai-yun-an, *Tsang 27648* (A).

Distinctive of the species are the extremely small 3-valved capsules and

the extremely slender elongate pedicels. It is somewhat allied to *P. sahnianum*.

The two names given to the species merit some discussion. Hayata described *P. oligocarpum* in 1911, basing it on a Formosan plant. In 1913 he described *P. oligospermum*, basing it on another plant from Formosa. This is not a case of misspelling or a variant of the name of *P. oligocarpum*, for he designated *P. oligospermum* as a new species. *Pittosporum oligocarpum*, and *P. oligospermum* have different type-specimens. However, in 1915, while treating another collection from Formosa, Hayata, though figuring and describing the species as *P. oligospermum*, quoted also the original references to *P. oligocarpum*. He did not distinguish between the two somewhat similar names, or perhaps he treated them as variants in spelling. Later Kanehira, in his several editions of Formosan Trees, quoted all the references pertaining to the two species of Hayata under *P. oligocarpum*. He also made no mention of the name *P. oligospermum*.

12. **Pittosporum sahnianum** sp. nov.

Pittosporum glabratum sensu Rehder & Wilson, Pl. Wils. **3**: 327 (1916), in part.

Arbuscula 3–6 m. alta; foliis oblanceolatis vel obovatis 6–10 cm. longis 2–3.5 cm. latis tenuiter coriaceis glabris, apice abrupte acutis vel acumina tis (acumine saepe plus minusve curvato); inflorescentia pseudoterminali umbellata pauciflora glabra; floribus non rariter polygamo-dioicis; sepalis membranaceis inaequalibus 2–3 mm. longis ovatis ciliatis obtusis vel acutis basi connatis; petalis 8–9 mm. longis; ovario pubescente; capsula ellipsoidali trigona medium versus latiore, apice acuta basi abrupte stipitata, 2–4 cm. longe pedicellata; valvis 3 haud crassis ellipticis; placenta basim versus et supra medium sterili funiculis brevibus rigidis; seminibus 15, 2–3 mm. longis atro-sanguineis.

Small tree or shrub, 3–6 m. tall; branching verticillate or forking; bark greyish or brownish speckled with conspicuous lenticels; leaf-scars on young branches crescent-shape, on older branches usually reniform; leaves alternate along and loosely verticillate towards the ends of the branches, blades usually 6–10 cm. long, 2–3.5 cm. wide (occasionally extremes 2–12 cm. long, 1.5–5 cm. wide), thin-coriaceous, glabrous, oblanceolate or obovate, tapering at base, apex usually somewhat abruptly acute or acuminate and slightly recurved, petioles 5–10 mm. long; inflorescences pseudoterminal, few-flowered, simply umbellate, glabrous, subtended by a whorl of leaves at base; pedicels usually 1–3 cm. long; flower-buds oblong; flowers occasionally polygamo-dioecious (*Wang 20486*, Szechwan); sepals glabrous, membranous, connate at base, 2–3 mm. long, unequal, ovate, obtuse or acute, often inconspicuously ciliate; petals usually 8–10 mm. long. Long-stamened flowers: filaments 6 mm. long; anthers 1.5–2 mm. long, well developed, oblong, yellow, equaling the level of or projecting slightly over the stigma; ovary cylindrical, hairy, poorly developed; definite glabrous stipe; style glabrous; stigma pointed. Short-stamened flowers:

filaments not surpassing the body of the ovary, 5 mm. long; anthers shrivelled, poorly developed, sagittiform, brownish, pollen undeveloped; ovary plump, globular, densely covered with whitish silky hairs; style glabrous; stigma capitate. Capsules usually in umbels of 2–5 (mostly 2, 3), often pendulous, greenish or blackish, ellipsoid, trigonous, broader at middle, apex acute, abruptly constricted at base into stipe, surface nearly smooth; fruit-stalk 2–4 cm. long; valve 3, thin, less than 1 mm. thick, firm, striate inside, brown, coated with resinous oily substance; funicles small, knob-like, distributed from just above the base to beyond the middle of the placenta, the base and apex of the placenta infertile; seeds about 15 per capsule, small, 2–3 mm. long, darkish red.

Very widely distributed species in China. It ranges from the northern side of the Yangtze drainage in Szechwan through Kweichow, Hunan, Kiangsi to Fukien, Chekiang and Kiangsu in eastern China. From Kiangsi-Chekiang it extends to adjoining southern Anhwei in the north and from Fukien southward into Formosa. Southern Anhwei and Kiangsu are the northernmost limits of *Pittosporum* distribution in eastern China.

FUKIEN: Minhow Hsien, Kushan Monastery, *Chung 2249* (TYPE, A); same locality, alt. 200 m., *Chung 2748* (A); Kushan, Foochow, *Chung 1288, 3690, 8090* (A); Kushan Monastery, *Tang 5779* (A); Inghok Hsien, *Chung 1357, 1364, 2633, 7758* (A); Kuliang and vicinity, alt. 800 m., *Chung 6405, 6639* (A); Central Fukien, *Dunn 2369* (A); North Fukien, *Ching 2264* (A); s. l., *Tang 3938* (A).

CHEKIANG: Westlake, near Ningpo, *Hu 1449* (A); Lung Chiung Hsien, *Hu 440* (A); Tien-tai-shan, *Hu 262* (A); Tien Moo Shan, *Ching 5052* (A); Tien-tai-shan, *Ching 1455* (A); Hang Chow, *Merrill 11268* (A); s. l., *Hsia 76* (A); Hai Wei Monastery, *Keng 2631* (A); Tsing Tien, *Keng 222* (A); Tien-tai Shan, alt. 150 m., *Keng 1086* (A); Changhua Hsien, alt. 300 m., *Keng 613* (A); Mo Kan Shan, *Cheo & Wilson 12788* (GH); Yen Tang Shan, *Chiao 14798* (A); s. l., *Ching 4779* (A).

KIANGSU: Lung-ge, south of I-shing, *Ching & Tso 438* (A).

ANHWEI: Chu Hwa Shan, South Anhwei, *Ching 2695* (A); West Chamen, South Anhwei, *Ching 3183* (A); Wang Shan, South Anhwei, *Ching 2904*; Tien Chu Shan, alt. 1000 m., *Fan & Li 232* (A); Chiuhwashan, alt. 700–800 m., *Sen 1209, 1415* (A); Wang Shan, *Steward 5491* (GH).

HUPEH: Patung Hsien, *Chow 57* (A).

SZECHWAN: Nanchuan Hsien, alt. 1200–1500 m., *Fang 795, 1265* (A); Nanchuan, *Bock v. Rosthorn 474* (A).

KWEICHOW: Tsing-long-san, Tsingchen, *Teng 90610* (A).

HUNAN: I-chia-ao, Changning Hsien, alt. 300 m., *Fan & Li 159* (A); Hsianghsiang, alt. 60–200 m., *Handel-Mazzetti 602* (A).

KIANGSI: Kuling, alt. 1600 m., *Wilson 1674* (A, GH); Hong San, *Gressitt 1647* (A); Pinghsiang, alt. 600 m., *Wang 140* (A); Lushan, alt. 700–800 m., *Chung & Sun 626* (A).

FORMOSA: Karenko Prov., *Wilson 11066* (A).

The specimens cited under this species were formerly accepted as a phase of *P. glabratum*. On close examination *P. sahnianum* does not

resemble *P. glabratum* at all. It differs from the latter in having (1) the pubescent ovary; (2) small trigonous, ellipsoid capsules with abruptly constricted stipe; (3) long fruit-stalk (2–3 cm. long); (4) short peg-like funicles; (5) small seeds; and (6) small flowers. This species, however, closely resembles *P. trigonocarpum,* but differs from it in the size and shape of its capsules and leaves.

Pittosporum sahnianum is dedicated to the memory of my former teacher, the late Dr. Birbal Sahni, F.R.S., who was Professor of Botany and Dean of the Faculty of Science in Lucknow University, India, until his death last year.

13. **Pittosporum illicioides** Makino, Bot. Mag. Tokyo **14**: 31, 32 (Japanese text), 32, 33 (English text) (1900); Makino, Bot. Mag. Tokyo **18**: 122 (1904). — Type: "Prov. Harima: Kishima-mura in Ibo-gori (U. Ouye: Feb. 1900)."

Evergreen shrub, glabrous; bark grey; lenticels inconspicuous; leaves loosely crowded towards the ends of the branches, coriaceous, blades obovate-oblong or obovate-lanceolate, 4–10 cm. long, 2–5 cm. wide, apex acute or acuminate, margin entire, petioles 5–15 mm. long; inflorescences 3–10-flowered, umbellate, glabrous; pedicels 14–30 mm. long, far shorter than leaves; flowers polygamo-dioecious, 7–8 mm. long; sepals slightly connate at base, unequal, 2–3 mm. long, ovate, obtuse, ciliate; petals 10 mm. long, yellow. Short-stamened flowers: filaments 5 mm. long; anthers sagittiform, 1.5 mm. long, without pollen; ovary 3-carpelled, slightly hairy, ovoid; style glabrous; stigma capitate. Long-stamened flowers: filaments 7 mm. long; anthers well developed, 2.5 mm. long; ovary slightly hairy, slender 3-carpelled; style glabrous; stigma not capitate.

JAPAN: Harima Province, *Masamune s. n.* (NY).

Since I have no material (except a sterile twig) for the study of this species, I have adapted the short description given above from that of Makino. According to him it is a rare species known only from Harima Province in Japan. Judging the vegetative characters and the description as given by Makino, this species does belong to the glabratum-complex.

Makino, Bot. Mag. Tokyo **18**: 122 (1904), states that the flowers are dioecious and describes them as "male" and "female" flowers, but from his description, "Stamens, erect, shorter than petals, glabrous, longer than pistil and 7 mm. long in the male flower, but shorter than pistil and 5 mm. long in the female flower. . . ." it is evident that the flowers are dimorphic, as in many other members of the glabratum-complex, where some individuals bear functionally unisexual flowers. Most of the dimorphic flowers show both the essential organs, although one or the other may be poorly developed. I have seen only a few specimens (from India) in *P. undulatum* which have true unisexual female flowers. In these the stamens are reduced to mere gland-like structures. But I have not seen any corresponding true male flower where the ovary has become rudimentary or absent.

Hence I have preferred to use long- and short-stamened flowers instead of "male" and female" flowers in my descriptions of species.

14. **Pittosporum pauciflorum** Hooker & Arnott, Bot. Beech. Voy. 168, *t. 32* (1833). — Type: China, *Beechey*.

Shrub 1–2 m. tall; branching verticillate or forking; bark grey or brown, speckled with lenticels; leaves loosely crowded towards the ends of the branches, blades obovate, elliptic, or oblanceolate, small, 3–6 cm. long, 1–2 cm. wide, thin-coriaceous, glabrous, apex acute, margin entire, slightly recurved, petioles short, 3–6 mm. long; inflorescences pseudoterminal, single-flowered or few-flowered, umbellate, glabrous or slightly pubescent, subtended by a whorl of leaves and bracts at base; bracts inconspicuously pubescent, narrowly lanceolate, 3–4 mm. long; pedicels slender and short, 5–15 mm. long, glabrous or inconspicuously pubescent; sepals free, narrow-lanceolate, 4–5 mm. long; petals white, 8 mm. long; filaments 5 mm. long; anthers 1–1.5 mm. long; ovary densely covered with silky brown hairs; capsules 3-valved, obovoid or globular, often angulate, small, 12–13 mm. long; fruit-stalk 5–20 mm. long; valves slightly woody, 1 mm. thick, obovate or nearly circular in outline, striate and brown inside; funicles 5–6 on each placenta, peg-like, very small, 1.5 mm. long, darkish brown, distributed usually in pairs on the middle section of the placenta, the base and apex of the placenta infertile; seeds 15–18, darkish red, irregular, 3–4 mm. long.

Known only from the coastal province of Kwangtung and its islands.

KWANGTUNG: s. l., *Beechey s. n.* (TYPE, K); Pak-wan Cheung, alt. 820 m., Wai-yeung district, *Tsui 140* (A); Tung-koo Shan, Tapu district, *Tsang 21571* (A); Lo Fou Shan, *s. c., 592* (A); s. l., *W. T. Tsang s. n.* (A).

HONGKONG: 1853–56, *Wright s. n.* (GH).

The collections of plants assembled during Captain Beechey's voyage of 1827 contained some Chinese specimens from in and around Macao and Canton. One of these specimens was described by Hooker & Arnott, in 1833, as *P. pauciflorum*. These authors did not mention any number or precise specimen as type, nor did they give any particular type locality. The species appears to have been poorly understood. Fortunately, Kew possesses the specimen on which Hooker & Arnott based their species. I have carefully examined it and found that the ovary is 3-carpelled, rather than bivalved as originally described. The distinctive characters of the species are as follows: (1) capsules trivalved, obovoid or globular, often angulate, small, 12–13 mm. long; (2) sepals free, glabrous, lanceolate, 4–5 mm. long; (3) flowers solitary or in few-flowered umbels; (4) petals 7–8 mm. long; (5) ovary tomentose with pale brown hairs; (6) funicles short, peg-like, 5 or 6 on each placenta, distributed in pairs on the middle section, the base and apex of the placenta infertile; (7) seeds 15–18 per capsule, small, irregular; and (8) leaves small, 3–6 cm. long, oblanceolate to elliptic. Of these characters, the first three are very important in the recognition of this species.

15. **Pittosporum tobira** (Thunberg) Aiton, Hort. Kew. ed. 2, **2**: 27, (1811); Sims, Bot. Mag. **34**: *t. 1396* (1811); De Candolle, Prod. **1**: 346 (1824); Putterlick, Synop. Pitt. 12 (1839); Ito, K. & Kaku, H., Fig. Desc. Pl. Koish. Bot. Gard. **2**: *t. 12* (1883); Penzig, Fl. Litt. Mediter. *t. 131* (1902); Mizoshi, Atlas Jap. Veg. *t. 89* (1909); Nakai, Fl. Sylv. Kor. **21**: 81, *t. 8* (1936).

Evonymus Tobira Thunberg, Nova Acta Reg. Soc. Sci. Upsala **3**: 19, 208 (1780); Thunb., Fl. Jap. 99 (1784).—Based on "*Tobira*" of Kaempfer: *Tobera S. Tobira*, Kaempfer, Amoen. Exot. **5**: 796, *t. 797* (1712).

Small tree or shrub, 2–6 m. tall; young parts downy with brown or whitish hairs; branching verticillate or forking, young branches bracteate at base; bark grey or brownish, speckled with lenticels; leaf-scars somewhat roundish and conspicuous; leaves deep green, shining above, paler beneath, alternate on long shoots, conspicuously crowded towards the ends of the branches, blades thick-coriaceous, 5–10 cm. long, 1–4 cm. wide, obovate or obovate-oblong, rarely obcordate, tapering at base, rounded or often emarginate at apex, margin entire, slightly recurved, petioles 5–15 mm. long; inflorescences pseudoterminal, subumbellate, downy with soft brown or whitish hairs, subtended by a whorl of leaves and bracts at base; bracts membranous, often greenish, usually brown, narrow-lanceolate, acute or acuminate, variable in size; bractlets minute, 1–2 mm. long, downy, lanceolate, acuminate; flower-buds oblong, 10–12 mm. long; flowers fragrant; sepals connate at base, 4 mm. long, ovate, obtuse or acute, downy; petals white, 12–13 mm. long, oblanceolate, rounded at apex; filaments 7 mm. long; anthers 2 mm. long, oblong; ovary downy with soft short brownish or whitish hairs, ovoid; style glabrous, 3 mm. long; stigma capitate; capsules downy with brownish hairs when young, glabrescent at maturity, globular-angulate with stipe 1–2 mm. long, borne singly or umbellately or subumbellately; fruit-stalk 15–20 mm. long; valves 3, rarely 4, 2 mm. thick, woody, broadly elliptic in outline; placental-ridge prominently raised and well marked with whitish gummy secretion; funicles peg-like, 2 mm. long, brownish, in two evident rows, imbedded in the gummy secretion along the placental ridge; seeds many, reniform, 5–7 mm. long, darkish red.

Known from southern Japan and southern Korea and islands adjacent, and also from coastal China, from Kiangsu and Chekiang to Kwangtung.

JAPAN: Najima, Kasuya, Tatana, *Tanaka 56, 179* (A, GH); Kyushu, Tanaga-shima, *Wilson 6120* (A); Yakushima, *Wilson 6089* (A); Hachijo Islands, *Wilson 8396* (A); Suma Kobe, *Uno 22590* (A); Susaki Tosa, May 1889, *Watanabe s. n.* (A); Yokohama, in 1862, *Maximowicz s. n.* (GH); Nagasaki, *Oldham 70* (GH); s. l., *Herb. Lugd. Batav. s. n.* (GH).

KOREA: Quelpart Islands, Saishu, *Wilson 9377* (A); Quelpart, in littore, *Faurie 553* (A); same locality, *Taquet 968* (A); Port Hamilton, in 1859, *Wilford s. n.* (GH).

KIANGSU: Soochow, Tien Ping Shan, *Tso 1715* (GH); same locality, *Ching & Tso 754* (A); same locality, *Feng 11* (GH).

CHEKIANG: Ping Yung, 1924, *Ching s. n.* (A).
KWANGTUNG: Canton and vicinity, *Levine 474* (A, GH).
SZECHWAN: Chengtu, cultivated on the college grounds, *Fang 12273* (A).

Pittosporum tobira is very common along sandy seashores and up to 200 m. altitude in coastal forests. It is said to flower in early summer in Japan.

The Japanese "*Tobira*" was the first *Pittosporum* to be described by western botanists. In 1712 Kaempfer described it under the name "*Tobira*" and figured it as "*Tobera*." In 1784 Kaempfer's account became the basis for *Evonymus Tobira* of Thunberg. Aiton, in 1811, made the combination *P. Tobira*, and gave a description based on a cultivated plant in Kew (this was a living plant selected by Kerr in Canton and sent by Kirkpatrick to Kew in 1804). The Kew plant was figured with a short description by Sims. Hooker & Arnott, Bot. Beech. Voy. 4: 168 (1833), stated, "The flowers in the wild state are not half the size of those represented in the Bot. Mag." It seems also that the inflorescences and young parts of the plant in the wild state are more pubescent than that which was shown in the figure in the Botanical Magazine.

Early botanists accepted as *P. tobira* plants from Formosa and the Ryu-Kyu Islands which have close resemblance to this species. In 1936 Nakai designated the plants from Formosa and Ryu-Kyu as two separate species. His description and figure are safe guides to the identification of *P. tobira*. The illustrations and habitat descriptions of Ito & Kaku are also excellent.

15A. **Pittosporum tobira** var. **macrophyllum** Nakai, Bot. Mag. Tokyo 41: 501 (1927). — Type: "Hondo, in silva templi inter Yugashima et Shuzenji Prov. Idzu, T. Nakai."

I have not seen the type nor any specimens belonging to this variety. According to Nakai, it differs from the species in having larger leaves (10–16 cm. long and 5–7 cm. wide).

15B. **Pittosporum tobira** var. **fukienense** var. nov.

Foliis obovatis 4–6 cm. longis 2–3 cm. latis; inflorescentia umbellata; capsulis globosis, angulatis; valvis 3.

Leaves 4–6 cm. long, 2–3 cm. wide, obovate, rounded at apex; inflorescences umbellate, glabrous, pseudoterminal, subtended by a whorl of leaves, without bracts or bractlets; pedicels 10–15 mm. long; flowers polygamo-dioecious, very fragrant; sepals free, glabrous, ovate, acute, 3–4 mm. long; petals white, 8–9 mm. long; capsules 9 mm. in diameter, globular, angulate; valves 3, 1 mm. thick.

Known from Fukien under semi-cultivation.

FUKIEN: Near Kushan Monastery, *Uong Sing Po 12130* (A); Amoy Kulangsu, cultivated in gardens, *Chung 5948* (A); s. l., *Chung 7528* (TYPE, A).

This variety differs from the species in having smaller capsules and umbellate and glabrous inflorescences.

15C. **Pittosporum tobira** var. **sukuraii** var. nov.

Foliis obovato-ellipticis vel oblanceolato-ellipticis 3–6 cm. longis, 1.5–3 cm. latis apice obtusis; inflorescentia subumbellata glabra.

Known only from the Bonin Islands.

BONIN ISLANDS: June 11, 1903, s. l., *Herb. K. Sakurai s. n.* (TYPE, A).

This variety differs from the species in the shape and size of its leaves and in its glabrous inflorescences.

16. **Pittosporum makinoi** Nakai, Fl. Sylv. Korea **21:** 84 (1936). — "Types." Formosa, Tansui, Nov. 1896, *T. Makino,* and *Bobokusi,* Apr. 1903, *S. Nagasawa.*

Pittosporum tobira sensu Kanehira, Formosan Trees 250, *f. 194* (1936).
Pittosporum tobira var. *calvescens* Ohwi, Jour. Jap. Bot. **12:** 331 (1936). — Type: Formosa, *Tanaka & Shimada 13539.*

Shrub 1–3 m. tall; branching verticillate or forking; lenticels sparse dot-like specks; leaf-scars inconspicuous, roundish; leaves usually crowded towards the ends of the branches, glabrous, blades coriaceous, 4–9 cm. long, 2–4.5 cm. wide, obovate or oblanceolate, tapering at base, rounded or obtuse at apex, margin entire, slightly recurved, petioles 5–15 mm. long; inflorescences pseudoterminal subumbellate, usually glabrous; bractlets minute 1 mm. long, usually glabrous, rarely pilose on margin; pedicels variable in length; flower-buds oblong, small, 6–8 mm. long; sepals connate at base, 3 mm. long, ovate, acute, glabrous, usually membranous and ciliate; petals 8–10 mm. long, obovate, rounded at apex; filaments 5 mm. long; anthers 2 mm. long; ovary pubescent, 2 mm. long, cylindrical with short stipe 1 mm. long; style glabrous, 3 mm. long; stigma slightly capitate; capsules 9–15 mm. long, 8–12 mm. thick, globular or subglobose, usually angulate; fruit-stalk 8–20 mm. long; valves 3, woody, 2–3 mm. thick; funicles short, 1–2 mm. long, in two rows, imbedded in gummy secretion on well-marked placental ridge; seeds many, darkish red, reniform, 5 mm. long.

Endemic to Formosa.

FORMOSA: Toyen Shinchiku-shu, *Tanaka & Shimada 13539* (A); Kurun, Tathoku-shu, *Tanaka & Shimada 11023* (A); Karenko, near Shinchow, *Wilson 11094* (A); Taihoku, Sozan Province, *Wilson 10790* (A); Taihoku, *Wilson 10285* (A); Taihoku, Oct. 1915, *Huzii 75* (A); Toyen, March 1914, *Faurie 449* (A); Tansui, *Henry s. n.* (A); s. l., 1864, *Oldham s. n.* (GH).

Pittosporum makinoi very closely resembles *P. tobira* and *P. lutchuense.* However, it differs from the former in having a glabrous inflorescence and from the latter in the shape and size of its sepals.

17. **Pittosporum lutchuense** Koidzumi, Pl. Nov. Amami-Osimensis 5 (1928). — Based on specimens from Amami O Shima Island, 1883, *Captain A. Carpenter,* and March 1924, *Z. Tashiro.*

Pittosporum pauciflora var. β? Hooker & Arnott, Bot. Beechey Voy. 259 (1833). — As to plant from Ryu-Kyu Islands.

Pittosporum denudatum Nakai, Fl. Sylv. Korea **21:** 84 (1936).—"Types": Ryu-Kyu, Okinawa, Nago, April 1907, *G. Nakahara;* Amami O Shima, Nov. 1900, *T. Uchiyama.*

Small tree or shrub, 2–6 m. tall; branching verticillate or forking; older branches with greyish bark speckled with minute lenticels, young branches with brown bark bearing persistent reduced leaf bases, glabrous or slightly pilose; leaf-scars more or less reniform; leaves alternate on the branches and towards the ends becoming crowded, blades coriaceous, slightly wavy towards the margin, glabrous, 3–10 cm. long, 1.5–3 cm. wide, usually oblanceolate, tapering towards the base, apex obtuse, margin entire, slightly recurved, petioles 5–15 mm. long; inflorescences pseudoterminal, slightly pilose, subumbellate, subtended by bracts and leaves at base; bracts lanceolate; bractlets minute, membranous; peduncles slender, varying in length from 2 to 4 cm.; flower-buds oblong, small, 5–7 mm. long; sepals connate at base, unequal, often irregular in outline, 2–3 mm. long, ovate, obtuse, or acute, glabrous, the margin membranous and inconspicuously ciliate; petals 7–8 mm. long, obovate-oblong, apex rounded; filaments 4 mm. long; anthers 3 mm. long; ovary cylindrical, 3 mm. long, pubescent; style glabrous, 3 mm. long; stigma pointed; capsules 12–14 mm. long, 10–12 mm. wide, globular, slightly angular; fruit-stalk 1–2 cm. long; valves 3–4, woody, 2 mm. thick, broadly elliptic in outline; placental ridge conspicuously raised all along the valve; funicles short, peg-like, inconspicuous, imbedded in the gummy secretion on the placental ridge; seeds many, irregular, 5 mm. long, pink.

Known from the Ryu-Kyu Islands and probably endemic there.

RYU-KYU ISLANDS: Okinawa: *Field & Loew 30* (A); *Wilson 8040* (A); *Uchida Hiroichi 9348* (A).

Pittosporum lutchuense is very closely related to *P. tobira,* but differs in having a pilose inflorescence and young leaves.

18. **Pittosporum parvifolium** Hayata, Icon. Pl. Formosa 3: 31 (1913). — Type: Bonin Islands, Chichijima, July 1905, *H. Hattori.*

Pittosporum Beecheyi Tuyama, Bot. Mag. Tokyo **49:** 445, *f. 8* (1935).—Type: Bonin Islands, Hahazima, July 15, 1920, *T. Nakai.*

Pittosporum pauciflorum var. *β?* Hooker & Arnott, Bot. Beechey Voy. 259 (1838).—As to plant from Bonin Islands.

Shrub 1–3 m. tall; branching verticillate or forking; bark greyish; lenticels conspicuous forming transverse slits on stems; leaves usually crowded towards the ends of the branches, glabrous, coriaceous, blades 2–5.5 cm. long, 1–3 cm. wide, obovate, frequently undulate near the margin, apex rounded, margin entire, slightly recurved, petioles 2–10 mm. long; inflorescences usually glabrous, few-flowered umbels or single flowers, pseudoterminal, subtended by a whorl of leaves at base; flowers fragrant; pedicels 4–5 cm. long, glabrous; sepals glabrous, ovate, acute, 3–5 mm. long, ciliate; petals white, free, oblong, 12 mm. long, rounded at the apex; filaments 6–8 mm. long; anthers 2 mm. long; ovary pubescent, 5 mm. long with short stipe 1 mm. long; style glabrous, 4 mm. long;

stigma capitate; capsules globose, 10–15 mm. in diameter, woody, solitary, borne on long fruit-stalk 4–5 cm. long, the torus of the fruit-stalk capitate; valves 3, woody, 3–5 mm. thick; funicles many, biseriate, peg-like, imbedded in gummy secretion on conspicuously raised placental ridge; seeds many, small, irregular, 3–4 mm. long, blackish red.

Endemic to Bonin Islands.

BONIN ISLANDS: South of Okimura, Hahashima, alt. 0–100 m., *Wilson 8274* (A).

Hayata's description of *P. parvifolium* is incomplete and fragmentary. He had not seen the flowers. He gave no information regarding the dehiscence of the capsule nor the length of the pedicel. Tuyama in his account of "Plantae Boninensis Novae vel Criticae" first brought *P. parvifolium* under "unifloral" in the key to the species of *Pittosporum* from the Bonin Islands. He separated *P. beecheyi* from *P. parvifolium* on the ground that the capsule of the former is dehiscent and the latter indehiscent. Of the five sheets of plants collected by Wilson in Hahashima, two agree with Hayata's description and three with that of Tuyama. But all five specimens were collected from the same locality and perhaps even from the same plant, for all bear the same number and identical notes. I cannot believe that they represent two different species. The differences seem due to the stunted and normal growth of the plant.

Pittosporum parvifolium is very closely allied to *P. boninense* and *P. chichijimense*. It differs from them in having long-pedicelled solitary or umbellate flowers. *Pittosporum boninense* is distinctive in having long-peduncled cymes with short-pedicelled flowers. *Pittosporum chichijimense* has short-peduncled cymes with long-pedicelled flowers.

19. **Pittosporum boninense** Koidzumi, Bot. Mag. Tokyo 31: 260 (1917). — "Distr. Japonia: The Bonin Islands"; Tuyama, Bot. Mag. Tokyo 49: 449 (1935). — In "Clavis Specierum Pittospori boninensis."

Shrub 2–4 m. tall, branching verticillate or forking; bark on older branches grey, on young branches brownish; lenticels on old branches dot-like specks, on young branches transverse slits; leaf-scars on young branches narrow and crescent-shaped, on old branches broad and reniform; leaves alternate and crowded, especially so towards the ends of the branches, glabrous, blades coriaceous, 4–10 cm. long, 1.5–4 cm. wide, obovate or obovate-oblong to broadly oblanceolate, broadest above the middle, tapering at the base, obtuse or rounded at the apex, margin entire and slightly recurved, petioles 1–3 cm. long; inflorescences minutely pubescent, pseudoterminal, subumbellate, subtended by a whorl of leaves; peduncles 2–5 in a cluster, 2–4 cm. long, each cymosely branched at the apex; pedicels 5–20 mm. long; bracts ovate, acute, 1–2 mm. long, early deciduous, membranous, glabrous, often ciliate; flower-buds oblong, 10–12 mm. long; flowers fragrant, polygamo-dioecious; sepals free, slightly pubescent, 3–4 mm. long, 2–3 mm. wide, broadly ovate, obtuse or rounded

at the apex, the margin membranous and slightly ciliate; petals white, free, 15 mm. long, obovate-oblong or oblanceolate, rounded at the apex, tapering at the base. Short-stamened flowers: filaments short, 3 mm. long; anthers almost abortive, sagittiform, 1.5 mm. long; ovary globular, 4 mm. long, densely tomentose bearing silky brownish appressed hairs, without stipe, style long, glabrous; stigma capitate. Long-stamened flowers: filaments 8 mm. long; anthers 2–2.5 mm. long, oblong; ovary 4 mm. long, cylindrical, without stipe, densely hairy; style 5 mm. long, the lower half hairy, the upper half glabrous; stigma slightly capitate; capsules woody, globose, 3-valved; valves woody, 3–4 mm. thick; funicles many, short, peg-like, in two rows on conspicuously raised placental ridge, imbedded in gummy substance; seeds many, darkish red, irregular.

Endemic to Bonin Islands.

BONIN ISLANDS: Chichijima, alt. 100–300 m., *Wilson 8251* (A); Hahashima, alt. 100–300 m., *Wilson 8289* (A); s. l., *Wright s. n.* (GH).

Pittosporum boninense is very closely allied to the other two endemics of the Bonin Islands, *P. chichijimense* and *P. parvifolium*. It differs from them in having long peduncles (20–35 mm. long) and short pedicels (5–20 mm. long).

20. **Pittosporum chichijimense** Nakai, Rigakkwai **26**: no. 5, 5 (1928) (*nomen nudum*); Bull. Biogeogr. Soc. Japan **1**: 258 (1930) (*nomen nudum*); Tuyama, Bot. Mag. Tokyo **49**: 446, *f. 9* (1935).—"Types": Bonin Islands, Titizima, June 30, 1920 and April 14, 1934, *T. Nakai.*

Shrub 1–1.5 m. tall; leaves obovate or obovate-oblong, rounded at apex, 8–15 cm. long, 3.5–5.5 cm. wide, coriaceous; inflorescences subumbellate; peduncles 10–25 mm. long; pedicels 40–60 mm. long, pendulous; flowers 12–15 mm. long; sepals connate at base, oblong, acute, 4.5–5 mm. long; petals white, 12–15 mm. long; stamens 8–8.5 mm. long, anthers triangular-ovate; ovary slightly hairy, 5–6 mm. long, 3-carpelled, rarely 4-carpelled; capsules globular, 10–13 mm. in diameter.

Endemic to the Bonin Islands.

I have seen no plant recognizable as belonging to this species. It is said to be endemic to the Bonin Islands and differs from *P. boninense* in having short peduncles and long pedicels. The short description given above is from the original Latin description of Tuyama.

21. **Pittosporum baileyanum** sp. nov.

Pittosporum balansae var. *angustifolium* Gagnep. Suppl. Fl. Gén. Indo-Chine **1**: 215 (1939).—Type: "Annam: rivière du Sud, près Hué (Squires)"; non *P. angustifolium* Lodd.

Frutex 1–2 m. altus; foliis anguste lanceolatis 6–12 cm. longis 1–3 cm. latis coriaceis glabrescentibus (vel secus venas pubescentibus) apice acuminatis vel acutis; inflorescentia pauciflora umbellata vel subumbellata dense tomentosa (pilis brunneis); floribus in alabastro ovatis acutis 4–6 mm. longis; sepalis anguste lanceolatis 5–6 mm. longis pubescentibus

acuminatis; petalis 7–10 mm. longis; ovario pilis rubro-brunneis evidenter obtecto; capsula 15–25 mm. longa 8–10 mm. crassa lateraliter compressa; valvis 2; placenta funiculis 2–4 donata; seminibus rotundis 4–8.

Shrub 1–2 m. tall; young parts slightly hairy; branching verticillate or forking; bark grey or brown; lenticels rarely evident; leaves glabrate or hairy only along the veins, crowded at the forks and towards the ends of the branches, blades 6–12 cm. long, 1–3 cm. wide, narrowly lanceolate, coriaceous, deep green above, pale green below, apex acuminate to acute, margin entire, petioles slender, short, 5–10 mm. long; inflorescences few-flowered, simply umbellate or subumbellate, densely tomentose with darkish brown long hairs; pedicels 5–10 mm. long, tomentose with dark brown hairs; bracts thin, very narrow lanceolate, acuminate, covered with dark brown hairs; flower-buds ovate, acute, 4–6 mm. long; flowers fragrant; sepals free, very narrow lanceolate, long-acuminate, 5–6 mm. long, hairy; petals white or yellow, narrow-lanceolate, 7–10 mm. long; stamens 6 mm. long; ovary 5 mm. long, very conspicuously covered with long reddish brown silky hairs, cylindrical and tapering into the short glabrous style; stigma capitate; capsules 15–25 mm. long, 8–10 mm. wide, laterally compressed, somewhat square in cross-section, undulate due to depression in the valve between the seeds, 2-valved; valves very thin, brittle, inner surface striate between the seeds; funicles 2–4 on each valve, alternate or in pairs, on one valve suprabasal and on the other medial; seeds large, roundish, 4–5 mm. long, 4–8 per capsule, pinkish black to bright red.

Known from southern Kwangsi, China and from Tonkin and Annam, Indo-China; also from the island of Hainan.

KWANGSI: Shap Man Taai Shan, Ping Hoh Village, s.e. of Shang-sze, Kwangtung border, *Tsang 22133, 22190, 22554, 23876, 24400, 24608* (A); Foo Lung, Sup Man Ta Shan, *Liang 69762* (A); Seh-Feng Dar Shan, S. Nanning, alt. 400 m., *Ching 7876* (A).

HAINAN: Yaichow, alt. 666 m., *How 70427* (NY); Lokwui, *How 72271* (A); Po-ting, alt. 400 m., *How 72601* (A); Bo-ting, *Lau 27949* (A); s. l., *Wang 34499* (NY).

INDO-CHINA: Annam, Hué and vicinity, *Squires 328* (TYPE, A); Tonkin, Vinh-yen, *Pételot 5967* (A), Pac-si and vicinity, Mon-cay, *Tsang 26952* (A), Taai Wong Mo Shan and vicinity, Ha-coi, *Tsang 29590* (A), Kau Nga Shan, Tien-yen, *Tsang 27438* (A).

A species very closely related to *P. balansae* and *P. confertum*. It differs from them mainly in its narrowly lanceolate leaves and sepals.

I feel it a great pleasure to associate the name of this species with that of Professor I. W. Bailey of the Biological Laboratories, Harvard University.

22. **Pittosporum confertum** Merr. & Chun, Sunyatsenia 2: *237, f. 46* (1935). — Type: Hainan, Ngai Yuen, *F. C. How 70519*.

Shrub or small tree 1–8 m. tall; young parts often tomentose with brown hairs; leaves alternating along the branch, with 2 or 3 loosely crowded towards the end, usually glabrous, blades 6–15 cm. long, 3–5 cm. wide,

ovate-lanceolate to oblong-lanceolate, coriaceous, apex acute to acuminate, margin entire, slightly recurved, petioles 5–10 mm. long; inflorescences composed of fascicles of sessile or subsessile flowers at the tips of the branches, densely covered with bright brown shining hairs; flower-buds ovate; flowers fragrant; sepals oblongish with acute or acuminate apex, 4 mm. long, covered with brown hairs; petals white, 6–7 mm. long; stamens short, filaments white, 5–6 mm. long, anthers yellowish brown, lanceolate, 1–5 mm. long; ovary ovoid or cylindrical, densely covered with brown hairs, 3 mm. long; style glabrous, short, 1 mm. long; stigma slightly capitate; capsules longer than broad, often compressed, 18–20 mm. long, 15 mm. thick, 2-valved; valves yellowish, thin, less than 1 mm. thick, striate inside; funicles 1–3 mm. long, slender, flat, alternate along the whole length of the placenta, usually only four on each valve; seeds 6–8 per capsule, red to brick-red, large, 5–6 mm. long.

Known only from Hainan.

HAINAN: Yaichow, alt. 500–660 m., *How 70427, 70519* (A, NY); Po-ting, alt. 760 m., *How 72924* (A); Ka Chik Shan and vicinity, Ch'ang-kiang district, *Lau 1589* (A, NY); Bo-ting, *Lau 27962* (A); Chim Fung Mt., Dan-en district, *Lau 3755, 5265* (A); Ue Lung Ling, Ch'ang-kiang district, *Lau 1504* (A, NY); Bak Sa, *Lau 26559* (A); Loktung, *Lau 27470* (A); Him Mai Shue, Tung Koo Shan and vicinity, Wen-ch'ang district, *Fung 20365* (NY), *20366* (A, NY); Yaichow, *Liang 62760* (A, NY), *62026, 62193, 63120* (NY); Pak Shik Ling and vicinity, Ching Mai district, *Lei 48, 515* (A, NY); Dung Ka to Wen Fa Shi, alt. 600 m., *Chun & Tso 43745* (A, NY); Dung Ka to Diu Mun, alt. 666 m., *Chun & Tso 44272* (NY); Tai Wan, San Hu, *McClure 8955* (A, NY); Tai Un, alt. 750 m., *McClure 7845* (A); s. l., *Wang 33313, 34397, 35239* (A, NY); s. l., *Liang 64284* (A, NY); s. l., *Tang 403, 416* (A).

Pittosporum confertum is very closely allied to *P. balansae* and *P. baileyanum* but differs from them in the shape and size of its leaves and sepals. According to some of the field reports, the fruits of this species are edible.

23. **Pittosporum balansae** De Candolle, Bull. Herb. Boiss. ser. 2, 4: 1071 (1904); Gagnepain, Bull. Soc. Bot. France sér. 4, 8: 544 (1908). — Type: Indo-China, Tonkin, Ouonbi, *Balansa 1418*.

Shrub 2–3 m. tall; young parts brown tomentose; branches verticillate or simply forking; bark greyish; leaves loosely crowded towards the ends of the branches, blades elliptic to ovate-elliptic, 4–6 cm. long, 2–3 cm. wide, bearing long brown hairs along the veins and sometimes over the whole of both surfaces, coriaceous, apex acute, margin entire, petioles 4–9 mm. long; inflorescences pseudoterminal, small dense clusters of subsessile flowers or somewhat umbellate or subumbellate with pedicels shorter than the petioles, densely dark brown tomentose; bracts narrow-lanceolate, 7–8 mm. long, acuminate, densely tomentose; flower-buds ovate, acute; sepals free, narrowly lanceolate, 5–6 mm. long, acuminate, densely reddish brown tomentose; petals oblongish, acute, 7–8 mm. long;

filaments 4–5 mm. long; anthers oblong, 1.5 mm. long; ovary cylindrical, 3 mm. long, densely covered with rusty brown hairs; style very short, 1 mm. long, glabrous with capitate stigma; capsules crustaceous, 18–20 mm. long, 14–16 mm. wide, somewhat ovoid, compressed, 2-valved; funicles slender, flat, usually 4 on each valve, distributed all along the placenta; seeds large, usually 8 per capsule, darkish red.

Known from Tonkin and Annam, Indo-China.

INDO-CHINA: Hue and vicinity, *Squires 362* (A); Dent du Tigre, Annam, *Poilane 10328* (A); En route to Vinh Dougha, *McClure 118, 3252* (A); Langbran Peak, *Greenway 26* (A); Mt. Bana, near Tourane, *Clemens 4273* (A); Thai Ngwyen, Tonkin, *Pételot 5552* (A).

Pittosporum balansae and its close relative *P. confertum* are easily separable in their extreme forms, but they are connected by many intergrades intermediate in character.

Pittosporum balansae is characterized by elliptic leaves usually hairy along the veins and crowded at the ends of the branches, and also, as compared with *P. confertum*, by its narrower and longer sepals (5–6 mm.). Some specimens from Hainan show one or more of these characters of *P. balansae*. These plants have been arbitrarily assigned to *P. confertum*.

The other related species, *P. baileyanum*, though it intergrades to a certain extent with *P. balansae* and *P. confertum*, has narrowly lanceolate leaves and is not readily confused with them.

24. **Pittosporum gagnepainianum** sp. nov.

Frutex ?; foliis obovatis vel oblanceolatis, 6–10 cm. longis 2–3.5 cm. latis, supra medium latioribus coriaceis glabris, apice rotundis vel obtusis; inflorescentia axillari; floribus ignotis; capsula lignosa; valvis 2, oblongis, 1 mm. crassis, 12–15 mm. longis, 10–12 mm. latis; placenta supra medium sterili funiculis brunneis 1 mm. longis rigidis biseriatis donata; seminibus pluribus nigrescentibus plus minusve compressis 4–5 mm. longis.

Branching verticillate; bark greyish brown; lenticels slit-like, prominent on branches and fruit-stalks; young branches, petiole-bases, and dormant buds at the ends of branches densely covered with short brown silky hairs; leaf-scars cordiform; leaves loosely verticillate towards the ends of the branches, blades wavy towards the margin, obovate or oblanceolate, broadest above the middle, tapering at the base, rounded or obtuse at the apex, 6–10 cm. long, 2–3.5 cm. wide; margin entire, strongly recurved, petioles slender and long, 1–3 cm. long, keel-like underneath, channelled above; inflorescences distinctly axillary, loosely crowded towards the ends of the branches; each leaf-axil bearing one stout, short peduncle, 10–20 mm. long, conspicuously marked with lenticels; each peduncle bearing 1–3 stout, short pedicels, 3–6 mm. long; flowers not seen; capsules 2-valved, woody, slightly longer than broad, subglobose with stipe 1–2 mm. long, slightly compressed, oblong in cross-section, broadest in the middle, borne singly or 2 or 3 on each peduncle; valves reflexed after dehiscence, woody, 1 mm. thick, 12–15 mm. long, 10–12 mm. wide, oblongish in outline, inner surface light brown, obliquely striate, outer surface reddish brown,

placenta not raised on the valve; funicles peg-like, dark brown, 1 mm. long, arranged in two rows from the base to or beyond the middle of the placenta; seeds many, black, somewhat flat, 4–5 mm. long.

Known from southern Annam, Indo-China.

INDO-CHINA: Annam, Cana, Prov. Thaurang, March 6, 1923, *Poilane 9609* (TYPE, A).

Pittosporum gagnepainianum is one of the most readily recognizable species in our area. Among its distinctive characters are the oblanceolate leaves tapering towards the base and rounded or obtuse at the apex; the long slender petioles; the axillary inflorescences; the slit-like lenticels; the color of its capsules; and the flat blackish seeds. The type was previously identified as *P. tobira*, probably because of its leaf form. It has, however, 2-valved fruit and does not belong to the tobira-complex. It is a member of the balansae-complex.

25. **Pittosporum chatterjeeanum** sp. nov.

Frutex; foliis lanceolatis 5–12 cm. longis, 1–3.5 cm. latis, tenuiter coriaceis glabris apice longe acuminatis; capsula 2 cm. longa 1 cm. crassa compressa; valvis 2 haud crassis extus flavescentibus intus ochroleucis; placenta basi usque ad apicem fertili funiculis paucis alternatis gracilibus compressis 2–3 mm. longis donata.

Shrub; bark brownish, speckled with whitish lenticels; leaves loosely crowded towards the ends of the branches, glabrous, thin-coriaceous, upper surface deep green, lower surface pale green, blades 5–12 cm. long, 1–3.5 cm. wide, lanceolate, usually broader at the middle, tapering towards the long-acuminate apex, acute at the base, margin entire, petioles slender, 10–12 mm. long; inflorescences pseudoterminal, somewhat umbellate, pubescent, peduncle and pedicel thin and short; flower-buds ovate, 6 mm. long, 3 mm. wide at the middle; calyx free, lanceolate, pubescent, 4 mm. long, acuminate, ciliate; corolla free, petals 7–8 mm. long; anthers opening by longitudinal slit; ovary pubescent, bicarpelled, style glabrous, stigma not capitate; capsules 2-valved, large, 2 cm. long, 1 cm. wide, oblong-ovoid, compressed, narrowly oblong in cross-section; valves thick-coriaceous, yellowish above, creamy inside; funicles few, alternate along the whole length of the placenta, slender, flat, 2–3 mm. long; seeds not seen.

Known from Upper Burma.

BURMA: Kang-fang, alt. 1500 m., in thickets along the river banks, *Ward 75* (TYPE, A); Myinmolekat, Mergui district, alt. 1800 m., *Parker 3118, 3121* (A).

The long-acuminate leaf-apex and the large capsule (2 × 1 cm.) make this one of the most readily recognizable species in our area. It is closely allied to *P. balansae* and *P. confertum*.

Pittosporum chatterjeeanum is named in honour of Dr. D. Chatterjee, Systematic Botanist at the Agricultural Research Institute, New Delhi, India, and my personal friend.

26. **Pittosporum henryi** sp. nov.

Frutex ?; foliis anguste lanceolatis vel oblanceolatis 6–12 cm. longis 1.5–2.5 cm. latis coriaceis glabris apice acutis vel acuminatis; capsula cyclindracea 14–15 mm. longa basi 2–3 mm. longe stipitata; valvis 2, 1 mm. crassis oblongis intus lutescentibus; placenta medium versus fertili, funiculis 6 geminatis gracilibus compressis 2 mm. longis donata; seminibus 10–12, atrosanguineis irregularibus.

Shrub ?, glabrous except for the dormant buds, which have inconspicuous short hairs; branches forking; bark greyish or brown; lenticels inconspicuous; leaves loosely crowded, 2–3 at the ends of the branches, blades narrow-lanceolate or oblanceolate, broader at or above the middle and tapering at both ends, 6–12 cm. long, 1.5–2.5 cm. wide, coriaceous, apex acute or acuminate, margin entire, slightly recurved, petioles slender, short, 5–10 mm. long, flowers not seen; pedicels in umbel of 2–4 at tips of the branches, short and thick, 5–10 mm. long; capsules cylindrical, 14–15 mm. long, with evident stipe 2–3 mm. long, 2-valved; valves thin, 1 mm. thick, oblong in outline, deeply concave inside and rounded-convex outside, inner surface whitish yellow, striate, outer surface light brown or greenish brown; funicles slender, flat, 2 mm. long, 6 on each placenta, arranged in 3 pairs on the middle section of the placenta, the base and apex of the placenta infertile; seeds 10–12 per capsule, darkish red, irregular.

SZECHWAN: s. l., *Henry 7042* (TYPE, A).

Pittosporum henryi is readily recognizable (1) by its cylindrical, 2-valved capsules with distinct stipe; (2) by its six funicles on each valve arranged in pairs on the middle section of the placenta; and (3) by its narrow-lanceolate or oblanceolate leaves.

The flowers are borne in simple umbels at the tip of the branches (pseudoterminal) and are subtended by leaves. Later in the year one or two lower axillary buds from the axils of the subtending leaves develop into vegetative shoots. If only one shoot develops, assuming the position of leading shoot, the pedicels bearing capsules are apparently lateral; if two shoots develop, the pedicels bearing capsules appear to be at the fork in between the two shoots.

27. **Pittosporum merrillianum** sp. nov.

Frutex; foliis late ellipticis vel ovato-ellipticis, 6–10 cm. longis 2.5–4 cm. latis coriaceis glabris nitidis utroque acutis; inflorescentia terminali brevi thyrsoidea; floribus ignotis; capsula ellipsoidea breviter compressa medium versus latiore; valvis 2 late ellipticis 12 mm. longis 10 mm. latis maturitate reflexis, intus laevibus; funiculis 2 median versus placentam orientibus; seminibus 3–4 laevibus 5–6 mm. longis.

Shrub; branching verticillate or forking; bark brown or greyish, speckled with large lenticels; leaves loosely crowded towards the ends of the branches, glabrous, firm, thick-coriaceous, blades smooth and shining, 6–10 cm. long, 2.5–4 cm. wide, broadly elliptic or ovate-elliptic, apex

bluntly acute, margin entire, slightly recurved, petioles usually 10 mm. long; inflorescences terminal, short, thyrsoid, subtended loosely at the base by 3 or 4 leaves, the latter bearing roundish dormant buds in the axils; peduncles short and thick, 5–6 mm. long; pedicels short and thick, 4–5 mm. long; flowers not seen; capsules ellipsoidal, slightly compressed, 2-valved, reddish brown, glabrous; valves reflexed after dehiscence, woody, 1 mm. thick, broadly elliptic in outline, 12 mm. long, 10 mm. wide, inner surface smooth, no striation on either side of the placenta; placenta bulging into placental ridge only in the middle of the valve and here bearing only one pair of brown knob-like funicles; seeds 3 or 4 per capsule, large, 5–6 mm. long, smooth, shining, pinkish black, covered with light brown thin dry arilloid coat.

Known from Annam, Indo-China.

INDO-CHINA: Annam, Nui-han-heo, prov. Nhatrang, Sept. 29, 1922, *Poilane 4819* (TYPE, A).

Pittosporum merrillianum is notable for having only a single pair of small button-like funicles at the middle of each placenta. Further characters distinctive of the species are the smooth inner surface of the valves; the pinkish black shining seeds covered with a dry thin arilloid coat; the terminal thyrsoid inflorescence; the thick-coriaceous leaves; the roundish dormant buds in the axils of the leaves subtending the inflorescences; and the ellipsoid bivalved capsules. The type specimen was identified as *P. pauciflorum*.

It is a privilege to associate the name of this species with that of Dr. E. D. Merrill, Professor Emeritus, in recognition of his extensive work on the tropical flora of the Far Eastern countries.

27A. **Pittosporum merrillianum** var. **poilanei** var. nov.

Frutex 3–4 m. altus; foliis oblongis vel elliptico-oblongis 10–18 cm. longis 3–5 cm. latis; petiolis 15–25 mm. longis.

Known from Annam, Indo-China.

INDO-CHINA: Annam, on the road to Nhatrang, alt. 500 m., Oct. 15, 1923, *Poilane 8215* (TYPE, A).

This variety differs from the species only in its larger oblong or elliptic-oblong leaves.

28. **Pittosporum undulatum** Vent., Jard. Cels. Pl. 76 (1800); Andrews, Bot. Repos. 6: *t. 383* (1804); Edwards, Bot. Reg. 1: 16, *t. 16* (1815); Mordant de Launay, Herb. Gen. L'Ama. 2: 86, *t. 86* (1817); De Candolle, Prod. 1: 346 (1824); Drapiez, M., Herb. L'Ama. Fleu 6: *t. 452* (1833); Putterlick, Synops. Pitt. 6 (1839); Bentham, Fl. Austral. 1: 111 (1863); Schnizlein, Iconogr. 4: *t. 234, f. 1–13* (1870); Sherff, Field Mus. Nat. Hist. Bot. 22: 552 (1942). — Based on a plant cultivated in the gardens of J. M. Cels (France).

Shrub or small tree 5–12 m. tall; bark grey; young branches often pubescent; young leaves and bracts pilose, adult leaves glabrous; leaves mostly crowded towards the ends of the branches, blades 6–10 cm. long,

1.5–3.5 cm. wide, undulate towards the margin, oblong-lanceolate or oblanceolate, both ends acute, margin entire, recurved, petioles 10–15 mm. long; inflorescences pseudoterminal, subumbellate, hairy, subtended by leaves and bracts at the base; bracts linear-lanceolate, densely hairy and ciliate with brown hairs; flowers white and fragrant, polygamo-dioecius (some specimens from south India bearing flowers with only an ovary, the stamens appearing as rudimentary organs); pedicels 15–20 mm. long; calyx 8–9 mm. long, split into two parts, one 2-lobed, the other 3-lobed, the lobes acuminate, ciliate with brown hairs; petals white, free or slightly connate at the base, 15 mm. long; filaments 6–7 mm. long (rudiments on South Indian specimens); anthers 2 mm. long; ovary pubescent, ovoid, 4 mm. long; style glabrous, 3 mm. long; capsules subglobose, apex slightly compressed, 10 mm. in diameter, 2-valved; valves woody; funicles small; seeds irregular, 3 mm. long, darkish red.

Native of New South Wales, Australia.

INDIA: Kodaikanal, Pulney Hills, alt. 1000–8000 ft., *Anglade s. n.* (A) (only female flowers, the stamens rudimentary); same locality, Sept. 30, 1913, alt. 7000 ft., *Saulicre 1089* (C); Ootacamund, Bot. Gard., *Wilson s. n.* (A) (of four sheets one bears only female flowers); Nilgiris, Nov. 1883, *Gamble s. n.* (C); s. l., *Sibpur Bot. Gard. Herb. 34402* (C).

CHINA: Kweichow, Anlung, Oct. 20, 1930, alt. 500 m., *Tsiang 7440* (NY).

Ventenat based this species on plants cultivated in France, said to have come from the Canary Islands. *Pittosporum undulatum* is a native of New South Wales. It was sent to Kew Garden in 1789 by Sir J. Banks [Rees, Cycl. 27 (1814)]. Outside Australia it occurs only as a cultivated or naturalized plant.

29. **Pittosporum ferrugineum** Aiton, Hort. Kew, ed. **2**: 27 (1811); Sims, Bot. Mag. **46**: *t. 2075* (1819); De Candolle, Prod. **1**: 346 (1824); Putterlick, Synops. Pitt. 8 (1839); Bentham, Fl. Austral. **1**: 112 (1863); Hooker, Fl. Brit. Ind. **1**: 199 (1872); King, Jour. As. Soc. Bengal **58**(2): 129 (1889); Banks & Solander, Illustr. Bot. Cook's Voy. **1**: *t. 11* (1900); Ridley, Fl. Malay Penins. **1**: 136, *f. 14* (1922). — Based on a plant cultivated in the Royal Botanic Garden, Kew.

Tree or shrub 10–20 m. tall; bark brown or grey, speckled with lenticels; young growth covered with rust-coloured soft silky hairs; adult leaves usually glabrescent or remaining hairy along the veins, blades elliptic-ovate or elliptic, 4–8 cm. long, 2–4 cm. wide, rarely 10 cm. long, 3 cm. wide, apex acute to acuminate, margin entire; petioles slender, 5–15 mm. long; inflorescences pseudoterminal, subumbellate, densely tomentose with rusty brown hairs; flower-buds small, ovate, acute, 4–5 mm. long; sepals free, small, narrowly lanceolate, 1–4 mm. long, acuminate, ciliate; petals 4–5 mm. long; filaments 2–3 mm. long, brown, anthers very small, brownish, 1 mm. long; ovary obovoid, 2 mm. long, covered with brown silky hairs, 2-carpelled, ovules 12–20; style glabrous, brown-

ish, 1.5 mm. long; stigma capitate; capsules globular, slightly compressed, small, 6–8 mm. in diameter, 2-valved; valves striate inside; funicles knob-like, reddish brown, distributed in two rows from the base to beyond the middle of the placenta; seeds 10–16, small, irregular, pinkish black.

Pittosporum ferrugineum is a native of Malaysia. It occurs as far west as the Nicobar Islands, but is not known from adjacent continental Asia.

NICOBAR ISLANDS: Feb. 18, 1846, *Didrichsen 3060* (A); *Kamphovenen 2415* (A); *King 572* (C); *Kurz s. n.* (C).

This species reaches only the border of our area. Until it is studied throughout its total geographic range it must remain confused and poorly understood.

30. **Pittosporum ovoideum** sp. nov.

Frutex 1–4 m. altus; foliis anguste elliptico-lanceolatis 4–9 cm. longis 1–3 cm. latis coriaceis glabris apice acutis vel acuminatis; inflorescentia pseudoterminali pauciflora vel uniflora umbellata vel subumbellata glabra; floribus in alabastro ovatis 5 mm. longis; sepalis liberis glabris 3–4 mm. longis anguste lanceolatis acuminatis ciliatis; petalis 6–7 mm. longis; ovario pubescente; capsula globosa vel subglobosa 12–14 mm. longa breviter compressa; valvis 2 ca. 2 mm. crassis; placenta basi usque ad medium fertili funiculis minutis crassis fuscis donata; seminibus numerosis parvis irregularibus.

Shrub 1–4 m. tall; branching verticillate or forking; bark grey or brown, speckled with lenticels; leaves loosely crowded towards the ends of the branches, blades narrowly elliptic-lanceolate, broader at or above the middle, 4–9 cm. long, 1–3 cm. wide, firmly coriaceous, glabrous, apex acute or acuminate, margin entire, recurved, petioles 3–15 mm. long; inflorescenses single-flowered or umbellate or subumbellate, pseudoterminal, glabrous, subtended by a whorl of leaves and bracts at the base; bracts inconspicuously pubescent, narrowly lanceolate, 3–4 mm. long; pedicels 5–10 mm. long; flower-buds ovate, acute at the apex, 5 mm. long; sepals free, narrow-lanceolate, acuminate, glabrous, 3–4 mm. long, ciliate; petals 6–7 mm. long; filaments 3 mm. long; anthers oblong, 2 mm. long; ovary densely covered with silky brown hairs, 3 mm. long, cylindrical; style glabrous, 2 mm. long; stigma slightly capitate; capsules globose or subglobose, 12–14 mm. long, woody, slightly compressed, 2-valved; fruit-stalk 5–20 mm. long; valves woody, 2 mm. thick, nearly circular or oblongish in outline, striate and coated with oily substance inside; funicles very small, knob-like, darkish, less than 1 mm. long, biseriate, arranged from the base to beyond the middle of the placenta; seeds many, small, irregular, darkish red.

Known only from Kwangsi, China.

KWANGSI: Yao Shan, Ping Nan, *Wang 39113* (TYPE, A); Lung-mu-an and vicinity, *Tsang 2777* (A); Yang-so and vicinity, *Fung 21114* (A).

Distinctive of the species is its ovate flower-buds, its free, narrow-

lanceolate glabrous sepals, (3–4 mm. long), and its small globular or subglobular woody 2-valved capsules. The type and other specimens cited under *P. ovoideum* were previously identified as "*P. pauciflorum*." It has, however, 2-valved fruit and ovate flower-buds and so cannot be assigned to *P. pauciflorum* nor to the TRIVALVAE.

31. **Pittosporum bicarpellatum** Nakai & Tuyama, Bot. Mag. Tokyo 49: 447, *f. 10* (1935). — "Types": "Bonin: sine loco speciali (leg. ? Aug. 25, 1878. — Typus fructus in Herb. Univ. Imp. Tokyo); sine loco speciali (leg? June 16, 1879. — Typus floris in Herb. Univ. Imp. Tokyo)."

Leaves crowded towards the ends of branches, oblong to elliptic, rarely ovate-elliptic, 6–11 cm. long, 2.5–4.5 cm. wide, acute to acuminate, coriaceous, petioles 5–20 mm. long; inflorescences pseudoterminal, few-flowered, subumbellate; peduncles 8–10 mm. long; pedicels 4–8 mm. long; sepals connate at base, 7 mm. long, slightly hairy outside; petals 13–14 mm. long; stamens 8 mm. long; ovary ellipsoid, 4 mm. long, 2-carpelled, tomentose with rusty hairs; capsules globose, subcompressed, 12–14 mm. in diameter.

Said to be endemic to the Bonin Islands.

I have seen no specimen recognizable as belonging to this species. According to its authors it is endemic to the Bonin Islands. The short description given above has been adapted from the original Latin description by Nakai & Tuyama.

32. **Pittosporum viburnifolium** Hayata, Icon. Pl. Formosa 3: 32 (1913); Kanehira, Formosan Trees 251, *f. 195* (1936). — Type: Formosa "Hab. Kotosho: leg. S. Sasaki, June 1911."

Shrub; bark grey; leaf-scars roundish; lenticels conspicuous as transverse slits on the bark; leaves crowded at forking and towards the ends of the branches, blades thick-coriaceous, oblanceolate, 10–12 cm. long, 3–5 cm. wide, apex obtuse to rounded, margin entire and decurrent along the petiole, revolute, veins 8–10 pairs, petioles stout, 1–2 cm. long; inflorescences terminal and paniculate or pseudoterminal and an aggregate of paniculate cymes, pubescent with brown hairs; peduncles variable in stoutness and length, 8–15 mm. long; pedicels 5–10 mm. long, densely hairy; flower-buds oblong; sepals connate at the base, ovate, obtuse, 3 mm. long, glabrous, rarely ciliate; petals 10–12 mm. long, oblong-obovate; filaments flat and ribbon-like, 5 mm. long, anthers sagittate; ovary ovoid, plump, densely covered with brown hairs, 5 mm. long; style short, glabrous, 2 mm. long; stigma capitate; capsules subglobose, 2-valved; seeds red, said to be 7 mm. long.

Endemic to Formosa.

FORMOSA: Onilobera, Botel Tobago, Feb. 7, 1920, *S. Sasaki s. n.* (A).

Distinctive of the species are the oblanceolate obtuse leaves, the subglobular 2-valved capsules, and the large flowers.

33. **Pittosporum ceylanicum** Wight, Illustr. Ind. Bot. 1: 173 (1839); Hooker f., Fl. Brit. Ind. 1: 199 (1872); Trimen, Fl. Ceyl. 1: 78 (1893) — Type: Ceylon, March 1835, Herb. Wight Prop., presented 1871 (K).

Small tree 5–6 m. tall; bark brown, speckled with lenticels; leaves glabrous, crowded towards the ends of the branches, blades 3–9 cm. long, 1–3 cm. wide, obovate-oblanceolate or oblanceolate, tapering towards the base, the apex obtuse or rounded, margin entire, slightly recurved, petioles 5–20 mm. long; inflorescences glabrous, pseudoterminal, long-peduncled, paniculately compound-umbellate; peduncles equalling or longer than the subtending leaves, 4–6 cm. long, pedicels short and varying in length; flower-buds oblong, 6–7 mm. long; flowers fragrant; sepals glabrous, ovate, acute, 2–3 mm. long, ciliate; petals yellowish white, linear-oblong, 8–9 mm. long; filaments 5 mm. long; anthers very small, oblongish, 1 mm. long; ovary densely covered with whitish brown hairs, short, 2–3 mm. long; style glabrous, 4–5 mm. long; capsules black, subglobose, young capsules covered with whitish brown hairs, compressed 2-valved; valves woody; funicles basal to suprabasal; seeds about 8, angular, closely packed in the capsule.

Known from Ceylon and from Nilghiri, South India.

CEYLON: March 1835, *Herb. Wight s. n.* (K); 1870, *Thwaites 476* (C, GH).

SOUTH INDIA: Dodalett (probably "Dodabetta" Mt. in Nilghiri), Dec. 22, 1861, *Sibpur Botanic Garden Herbarium 34400* (C); s. l., *Wight 80* (C).

Trimen states that *P. ceylanicum* is endemic to Ceylon. Two specimens from Sibpur Botanic Garden Herbarium, however, come from South India. On the label of the first Indian specimen cited there is written "Dodalett," probably a misspelling for Dodabetta Mt. in Nilghiri. *Wight 80* is from South India and probably from Nilghiri. Though both the specimens lack precise locality, there is no doubt that they are from South India.

Pittosporum ceylanicum forms a large shrub or small tree growing on the banks of water courses in the more elevated parts of Ceylon. According to Trimen it is common also in the moist low country and extends into the mountain zones up to 2000 m. altitude. It is one of the readily recognizable species in our area. Very distinctive are its narrow-oblanceolate obtuse leaves, and its inflorescences that equal or surpass the leaves.

34. **Pittosporum dasycaulon** Miquel, Analecta Bot. Ind. 3: 5 (1850); Hooker f., Fl. Brit. Ind. 1: 199 (1872); Talbot, Forest Fl. Bombay Presidency and Sind 1: 82, *f. 54* (1909). — Type: S. India, from Hoobli, *Metz 775*.

Small tree with young branches, leaves, and inflorescences densely rusty brown tomentose; bark brown, speckled with promient lenticels; leaves glabrescent, loosely crowded towards the ends of the branches, blades thin-coriaceous, lanceolate, 5–9 cm. long, 2–3 cm. wide, apex

bluntly acute, margin entire, petioles 5–10 mm. long, densely rusty brown tomentose; inflorescences pseudoterminal, subumbellate to compound-umbellate; sepals small, free, ovate, 2 mm. long, tomentose; petals oblong, yellow, 10 mm. long; filaments 6–7 mm. long, anthers 2 mm. long; ovary 3 mm. long, hairy; style glabrous 5 mm. long; stigma capitate; capsules bivalved, globular, slightly compressed, woody; valves white inside, yellowish brown outside; funicles short, peg-like, brown, basal to suprabasal; seeds 4–6, irregular, blackish pink.

Known only from south India, and probably endemic there.

SOUTH INDIA: Concan (Konkan), *Stocks s. n.* (C, GH); North Canara (Kanara) Tinai-ghat, 1891, *Talbot 2513* (C); Gersoppa Falls, Mysore State, *Talbot 755* (C).

This species is very closely related to *P. eriocarpum* but differs from it in the thin-coriaceous lanceolate glabrescent leaves and also in its isolated southern distribution. *Pittosporum dasycaulon* is a common evergreen tree in moist rainy forests of North Canara, Concan, Bombay, Belgaum, and Shimoga in South India. According to Talbot it replaces *P. floribundum* in these moist rain forests. It flowers in the cold season from November to January.

35. **Pittosporum eriocarpum** Royle, Illustr. Bot. Himal. 1: 77 (1839); Hooker f., Fl. Brit. Ind. 1: 199 (1872); Brandis, Forest Fl. Ind. 19 (1874); Hooker f., Bot. Mag. 122: *t. 7473* (1896). — Type: Hab. From above Sansadhara to Mussooree, or from 3000 to 6700 ft. of elevation in 30½° of northern latitude."

Small tree with spreading branches; leaves, young branches, and inflorescences conspicuously covered with brownish tomentum; bark thin and on the older branches conspicuously speckled with lenticels; leaves loosely crowded towards the ends of the branches, blades broadly obovate-oblong or obovate or oblanceolate-oblong, coriaceous, 6–15 cm. long, 3–5 (–8) cm. wide, lower surface loosely tomentose, upper surface tending to be glabrescent, apex acute to acuminate, margin entire, recurved, petioles 15–20 mm. long, tomentose; inflorescences terminal or pseudoterminal; paniculately corymbose; peduncles 2–4 cm. long; bractlets conspicuously hairy; flower-buds 8 mm. long, oblong, yellow; flowers sweet-scented; sepals short, triangular, acute, free or slightly connate at the base, 2 mm. long, densely tomentose; petals oblong, 9–10 mm. long, glabrous, golden yellow; filaments slender, 5–6 mm. long, anthers slender, 2.5 mm. long; ovary 2 mm. long, densely covered with long silky hairs; style glabrous, 3 mm. long; stigma capitate; young capsules densely tomentose, matured capsules remaining hairy, globular, 8–12 mm. in diameter, laterally compressed, bivalved; valves thick and woody; funicles very small, distributed in pairs from the base to the middle of the placenta; seeds many, small, irregular, blackish red.

Endemic to northwest outer Himalaya.

INDIA: Gurwhal: alt. 1000–1300 m., *T. Thomson* (G, GH); *King s. n.* (C); *Boyle s. n.* (C); *Falconer* ex hb. Hauniense *304* (A). Mus-

soorie: March 1930, *Kirat Ram s. n.* (A); *Chandan singh Rawat 10* (A); *Mackinnon s. n.* (C); *Nai Sanon Samnasena 10* (C); Dehra Dun, May 1897, *Mackinnon s. n.* (C); near Mussoorie 1869, *King s. n.* (C); Arnighat, Mussoorie, June 13, 1894, *Forster 31* (C); hills below Mussoorie, May 3, 1870, *Sibpur Bot. Gard. Herb. 34312* (C); between Rajpur and Mussoorie, April 1911, *Parker s. n.* (A); Rajpur Road, alt. 1000–1300 m., *Stewart 11030* (A); Rajpur, alt. 1200 m., June 1891, *Gamble 22793* (C); above Rajpur, 1878, *Sibpur Bot. Gard. Herb. 34308* (C). Kumaon: Sirmoria, alt. 1300 m., *Strachey & Winterbottom 2* (GH); *Boyle s. n.* (C); *Gill 431, 727* (C); *Sibpur Bot. Gard. Herb. 34313* (C).

Pittosporum eriocarpum is very easily recognized by the persistent indument on its mature fruits and adult leaves. It is very closely related to *P. dasycaulon* of South India. It is said to flower from March to April and to fruit from June to July.

36. **Pittosporum neelgherrense** Wight & Arnott, Prod. Fl. Penins. Ind. Orient. 1: 154 (1834); Wight, Illustr. Ind. Bot. 1: 172, *t. 70/489* (1839); Hooker f., Fl. Brit. Ind. 1: 198 (1872). — Type: S. India, *Wight 141.*

Shrub or small tree 4–8 m. tall, glabrous except the leaf-axils and ovary; bark brownish, speckled with lenticels; branching loosely verticillate or forking; leaves loosely crowded towards the ends of the branches; blades coriaceous, elliptic-lanceolate to obovate, glabrous, 4–10 cm. long, 1.5–5 cm. wide; apex acute to obtuse or often acuminate; margin entire, petioles 5–15 mm. long; inflorescences glabrous, shorter than the leaves, pseudoterminal, subumbellate; flower-buds usually ovate, 6–8 mm. long; flowers fragrant; sepals minute, 1 mm. long, glabrous, triangular, acuminate, ciliate; petals narrowly oblong to lanceolate, 7 mm. long, yellow; filaments slender, 4 mm. long, anthers 1 mm. long, linear; ovary densely tomentose with brown hairs, 2 mm. long; style glabrous, 3 mm. long; capsules globular, slightly compressed, woody, bivalved; valves thick; funicles small, basal to suprabasal; seeds 4–6.

Known from South India and from Ceylon.

SOUTH INDIA: without locality (probably from Nilgiri Hills), *Wight 77, 78* (C, GH), *141* (K, NY); Nilgiri Hills, 1834, *Schmid s. n.* (C); Thia Shola, alt. 2100 m., 1913, *Fischer 3542* (C), alt. 2600 m., 1870, *Clarke 10693, 11122* (C); Shembaganur, alt. 2000 m., *Saulieres 398* (A, C); Coonur, 1921, *Wilson s. n.* (A); alt. 2000 m., 1882, *Brandis s. n.* (C); 1883, *Gamble 11274, 11436* (C); *King s. n.* (C); *Fischer 883* (C). Coimbatore, Bolampatti Hills, Varadimalai, alt. 1600 m., 1911, *Fischer 2754* (C); Mysore State, Santaveri, alt. 1600 m., 1894, *Talbot 3213* (C); s. l., *King 1013A, 1013B* (C).

CEYLON: *Thwaites 572* (C, GH).

The plant is absolutely glabrous except for the tomentose ovary and the shortly and densely pubescent leaf-axils. The hairs are reddish brown and shining as compared to the whitish silky hairs of *P. floribundum*. The ovary in *P. neelgherrense* is densely tomentose with brown hairs; the sepals are quite free, minute, acuminate, glabrous and ciliate; the flower-

buds are ovate and the valves of the capsules somewhat woody. Thus *P. neelgherrense* differs from *P. floribundum* and all other South Indian *Pittospora*. It is said to flower from February to March. The plant when bruised smells aromatic.

37. **Pittosporum nervosum** (Gagnep.) comb. nov.

Pittosporopsis nervosa Gagnep., Not. Syst. **13:** 136 (1947).—Type: Indo-China, Tonkin, *Poilane 25530.*

Tree 6 m. tall; bark brown, speckled with lenticels; leaves alternate, glabrous, coriaceous, blades oblong to oblong-lanceolate, 10–22 cm. long, 3–7 cm. wide, lateral veins on ventral face conspicuous and subparallel, lengthening to form submarginal veins, apex bluntly acuminate, margin entire, petioles 1·5–20 mm. long; inflorescences supra-axillary, paniculately branched, glabrous; minute prophyll-like and epicalyx-like structures on the ultimate support of the flowers minutely pubescent with short shining golden hairs; flower-buds oblong, 5 mm. long, reddish brown; calyx very shallow cup-like with short obtuse lobes 1 mm. long; petals free, oblanceolate, 6 mm. long, outer surface minutely pubescent; filaments flat, ribbon-like, the connectives projecting beyond the anthers, anthers whitish; ovary glabrous, ovoid, tapering to the pointed glabrous style; capsules not seen.

Known from Tonkin, Indo-China, and from Yunnan, China.

INDO-CHINA: Tonkin, *Poilane 25530* (A).
CHINA: Yunnan, Szemao, *Henry 11778B* (NY).

This remarkably distinct species has no close relatives in our region. Such characters as the supra-axillary inflorescences and shallow cup-like calyx immediately separate it from all congeners in this area. It is unfortunate that we do not know its capsules.

38. **Pittosporum formosanum** Hayata, Jour. Coll. Sci. Tokyo **22:** 32, *t. 4* (1906); Hayata, Mat. Formosa 34 (1911); Hayata, Icon. **1:** 64 (1911); Kanehira, Formosan Trees 249, *f. 192* (1936).—"Types," Formosa "Hab. Kaisa et Kiko, leg. C. Owatari, anno. 1896; Takow, leg. A. Henry, No. 52: Reigaryo, leg. C. Owatari, anno. 1898."

Small tree or shrub; young growth covered with rusty brown hairs; leaves loosely crowded towards the ends of the branches, blades often wavy towards the margin, elliptic-obovate to elliptic-oblong, 4–10 cm. long, 1.5–3 cm. wide, apex acute, margin entire, slightly recurved, petioles 5–10 mm. long; inflorescences terminal, compound-corymbose, pyramidal, pubescent with rusty brown hairs; bracts varying in size from normal leaf size to minute and inconspicuous; pedicels 5–10 mm. long; flower-buds small, 3–5 mm. long; sepals free or slightly connate at the base, oblong, glabrous, obtuse or rounded at the apex, non-ciliate; petals white, 5 mm. long; ovary glabrous, blackish; style glabrous; capsules globose, small, 6–7 mm. in diameter, 2-valved; valves thin, somewhat circular in outline, striate inside; funicles brownish, knob-like, small, basal to suprabasal; seeds irregular, black, up to 16 per capsule.

Known from Formosa and from Tonkin, Indo-China.

FORMOSA: Takao, Tainan, *Wilson 9853* (A); Kurarei, Koshusa, *Wilson 11001* (A); Takao, *Henry 1058, 1888* (A); South Cape, *Henry 256, 977* (A); Bankinsing, *Henry 48, 822* (A); Kurarei, alt. 150 m., *Gressitt 31* (A).

INDO-CHINA: Village de Noi Due, *Pételot 5553* (A).

Pittosporum formosanum is closely related to *P. kerrii, P. napaulense,* and *P. floribundum,* but it differs sharply from them in its glabrous ovary, in the shape and size of its sepals, and in the number of seeds per capsule.

38A. **Pittosporum formosanum** var. **hainanense** Gagnepain, Fl. Gen. Indo-Chine 1: 238 (1909), and Suppl. 1: 214 (1939). — "Types": "Tonkin; rapides de Bac-ninh, Quang-yen (Balansa); vers Ninh-binh (Bon). — Hainan."

Small tree, aromatic, 2–12 m. tall; flowers fragrant, yellow or white; ovary pubescent.

Known from Hainan and from Tonkin, Indo-China.

HAINAN: Ngo Ko Shan, near Tsat Cha Village, *Lau 1829* (A); Lok-tung, *Lau 26794* (A); Chim Fung Ling, Sam Mo Watt Village, *Lau 3895* (A); Ka Chik Shan, *Lau 2964* (A); Chiu Sam Tsuen, *Lau 368* (A); Kap Shan, *Lau 1187* (A); Bak Sa, *Lau 27581* (A); Kumyun, *Lau 27631* (A); Yaichow, *How 70891* (A); same locality, alt. 35 m., *Tso 44533* (A); Nam Shan Ling, *Tso 23032* (A); Tung Koo Shan, near Shan Hoi Village, *Fung 20386* (A); Hop Po, *Liang 69345, Wang 33027, 33865, 34965, 34974* (A); Lam Ko district and vicinity, *Lei 1476* (A); Hoihow, *McClure 7612* (A).

INDO-CHINA: Tonkin, 1890–1891, *Balansa 4883* (A).

This variety differs from the species in having a pubescent ovary.

Gagnepain named the variety *hainanense* but cited specimens only from Indo-China. The variety is widely distributed in Hainan.

39. **Pittosporum humile** Hooker f. & Thomson, Fl. Brit. Ind. 1: 198 (1872); Kanjilal and Das, Fl. Assam, part 1, 1: 96 (1935). — Type: "Khasia Hills, banks of the Borpani River, alt. 5000 ft., H. f. & T."

Small much-branched shrub 1–2 m. tall; young parts inconspicuously pubescent with whitish hairs; bark brownish grey, conspicuously speckled with whitish lenticels; leaves alternate along and loosely crowded towards the ends of the branches, blades glabrous, coriaceous, narrow-lanceolate, 30–60 mm. long, 8–10 mm. wide, apex bluntly acute and apiculate, margin entire, petioles 5–10 mm. long; inflorescences terminal or pseudoterminal or axillary, subumbellate, pubescent with minute rusty hairs; bracts lanceolate, pubescent; flower-buds somewhat ovate, 4–5 mm. long; sepals lanceolate or broadly lanceolate; acute to obtuse, 3–4 mm. long, pubescent; petals yellowish green or white, 5–6 mm. long; ovary glabrous; style glabrous, 3 mm. long; stigma capitate; capsules very small, globular, 5–6 mm. in diameter, bivalved; valves very thin, circular in outline; funicles very small, peg-like, brown, basal to suprabasal; seeds 6–9 per capsule, black, irregular, small.

Known only from Assam; probably endemic there.

INDIA: Assam, Khasia Hills, alt. 3142 ft., Sept. 7, 1924, *Ruse 407* (A); same locality, alt. 2000 ft., *Hooker & Thomson s. n.* (C, GH); Borpani, alt. 3000 ft., May 13, 1885, *Clarke 38193* (C); Bishop's Hills, Shillong, alt. 4200 ft., Sept. 26, 1885, *Clarke 40538* (C); Oct. 1890, *Robertson s. n.* (C); alt. 3000–4000 ft., June 1876, *Kurz 528* (C).

Among the species of *Pittosporum* known from Assam, *P. humile* is remarkably distinct in its small narrow-lanceolate leaves as well as in its glabrous ovary. It can readily be separated from any other Indian *Pittosporum* by its leaf-form alone. It is very closely allied to *P. pulchrum* but differs from it in the shape of its leaves and in its glabrous ovary. Kanjilal and Das have stated that the shoot smells like garlic when bruised.

40. **Pittosporum brevicalyx** (Oliv.) Gagnep., Bull. Soc. Bot. France **55:** 545 (1908).

Pittosporum pauciflorum var. *brevicalyx* Oliver, Hook. Icon. Pl. **16:** *t. 1579* (1887).—"Types": "Hab. China: Ichang, Dr. Henry; Kiukiang, Mr. Maries."

Pittosporum brevicalyx var. *brevistamineum* Gagnep., Bull. Soc. Bot. France **55:** 545 (1908).—"Types": Yunnan, *Delavay 2034* and *Ducloux 3284.*

Pittosporum neelgherrense var. *laxiflora* Franch., Bull. Soc. Bot. France **33:** 414 (1886).—Type: "Yunnan: in Silva Ta-long-tan, prope Tapin-tze, alt. 1800 m.; fl. 28 April 1886 (Delav. n. 2034)."

Evonymus provicarii Lévl., Cat. Pl. Yun-Nan 34 (1915).—Type: Yunnan, "Collines rocheuses de Pi-ka-tong, 2550 m., Mai 1912 (E. E. Maire)."

Shrub or small tree 4–10 m. tall; branching simple or verticillate; bark grey or brownish, speckled with whitish lenticels; leaves glabrous, coriaceous, blades lanceolate or oblanceolate to obovate-lanceolate, rarely obovate, 4–12 cm. long, 2–5 cm. wide, apex acute to acuminate, rarely obtuse on the same plant with acute ones, margin entire, slightly recurved, petioles 10–25 mm. long; inflorescence terminal to pseudoterminal, usually well-branched panicles, flowers fragrant, polygamo-dioecious; sepals free or slightly connate at the base, very variable membranous, irregular in outline, sometimes lanceolate, obtuse to acuminate, 1–3 mm. long, glabrous or pubescent, usually ciliate; petals golden yellow to whitish yellow, 6–8 mm. long; short stamens 2–3 mm. long, anthers poorly developed, long stamens 6–7 mm. long, anthers well developed; ovary tomentose with silky whitish hairs; style short and glabrous; stigma capitate; capsules globular, small, slightly compressed, 8–10 mm. in diameter, 2-valved; valves thin, striate inside; funicles small, knob-like, reddish brown, suprabasal; at maturity usually seeds 5–10 per capsule.

A widespread species in China. Common in Yunnan and ranging thence eastward and southward into Kweichow, Hunan, Kwangsi, and Kwangtung.

YUNNAN: NW. Likiang, *Ching 20684, 20575, 20573* (A); Thou Ty, *Ten 554* (A); Ouei Kou Mo Tsin, Kouty, *Ten 229, 458, 586* (A); Talong-tan, 8 Juin 1888, *Delavay s. n.* (A); along the Chungtien river, *Rock 9790* (A); Hsiang-shui Kwan between Lufung and Shetse, alt. 3200 m.,

Rock 25220 (A); Helungtan, *Feng 166* (A); S. Chungtien, Zun-lan on Yangtze bank, alt. 2400 m., *Feng 3363* (A); Kien-shuei Hsien, alt. 1900–2000 m., *Tsai 53118, 53038* (A); without locality, *Tsai 57282, 57539, 57295* (A); Yo-lin-ham, *Ducloux 7177* (A); near Feng-tai-szu, Chengkiang, alt. 1790 m., *Tsiang & Wang 16075* (A); Chi-ling Shan, Chengkiang, alt. 1900 m., *Tsiang & Wang 41644* (A); Hsiao-fu-dse, alt. 2250 m., *Handel-Mazzetti 6189* (A); without locality, *Forrest 10888* (A); *Liu & Wang 82681* (A); Pi Ka Tong, May 13, 1911, alt. 2250 m., *Marie s. n.* (A).

KWEICHOW: Tuyun and Patschai, alt. 700 m., *Handel-Mazzetti 242* (A).

KWANGSI: Ling Wan, *Lau 28761, 28809* (A); Loh Hoh Tsuen, Ling Yun Hsien, alt. 1150 m., *Steward & Cheo 243* (A).

HUNAN: Ping Tou Shan, T'ang Wan village, Yi Chang district, *Tsang 23649* (A).

KWANGTUNG: Yu-yuen in woods, *Ko 52596, 52638* (A); Yu-yuen on rocks, *Ko 52762* (A).

Pittosporum brevicalyx is closely related to *P. kerrii, P. napaulense,* and *P. floribundum* but differs from them in having unequal and irregular sepals (1–3 mm. long), somewhat large flowers, and 6–10 seeds per capsule.

41. **Pittosporum napaulense** (De Candolle) Rehder & Wilson, Pl. Wils. **3**: 326 (1916).

Celastrus verticillatus Roxb., Hort. Bengal. 18 (1814), *nomen nudum*, not *C. verticillatus* Ruiz & Pavon (1802).

Celastrus verticillata Roxb., Fl. Ind. **2**: 391 (1824), not *P. verticillatum* Boj. (1842) nor *P. verticillatum* Montr. (1860) — based on a cultivated plant grown from seeds collected by Buchanun in Nepal.

Senacia napaulensis De Candolle, Prod. **1**: 347 (1824) — based on a plant from Nepal.

Tree or shrub; branching simple or verticillate; bark brown, speckled with lenticels; leaves loosely crowded towards the ends of the branches, dark brown, blades often undulate towards margin, 8–20 cm. long, 4–8 cm. wide, oblong-elliptic to oblong-lanceolate, glabrous, thick-coriaceous, apex acute to accuminate, margin entire, slightly recurved, veins on the lower surface prominent, petioles usually 1–2 cm. long, sometimes 2–3 cm. long and stout; inflorescences usually terminal, sometimes pseudo-terminal, profusely branched, paniculate or paniculately compound-corymbose, tomentose with brownish hairs; sepals usually free or slightly connate at the base, broadly elliptic or ovate, glabrescent, 1–3 mm. long, conspicuously ciliate; petals 5 mm. long, yellow, narrowly oblong, obtuse; filaments 3 mm. long; anthers 1–1.5 mm. long; ovary pubescent, blackish, globular, 2 mm. long; style glabrous, 1 mm. long; stigma capitate; capsules globular, small, 6–7 mm. in diameter, 2-valved; valves thin, circular in outline, brown and striate inside; funicles small, basal to suprabasal; seeds small, usually 4–8 per capsule, blackish red, irregular.

Known along the foot of the outer Himalayas in Assam, Bhotan, Tibet, Sikkim, and Nepal.

INDIA: s. l., 1826, *Wallich s. n.* (labeled as *Celastrus verticillata* Roxb., *Senacia napaulensis = P. floribundum*) (A); Sillet, *Wallich 8127E* (C); Nepal, *Wallich 8127D* (C); s. l., *Wallich 1128, 8127A* (C); Shillong, Dumpep, alt. 2000 m., *King s. n.* (C); East Himalaya, *Griffith 270* (GH); Sikkim, alt. 2000 m., *Hooker s. n.* (GH); Khasia Hills, alt. 2000 m., *Hooker s. n.* (C, GH); Mungpoo, alt. 2300 m., *Hooker s. n.* (C); May 1900, *Prain s. n.* (C); Karponang, alt. 300 m., *Ribu & Rhomoo 4647* (C), same locality, 1887, *King s. n.* (C); Rangyroon, 1877–1878, *Lister s. n.* (C); Takdak Forest, alt. 2000 m., *Lace 2204* (C); *Gammie s. n.* (C); *Gallatly 651* (C); *Clarke 18806* (C); Langkyrdem, alt. 1700 m., *U. Kanjilal 6179* (C), *Mann s. n.* (C); Brahmaputra plains, alt. 1600 m., *Kurz 156* (C); Darjeeling, Lissoon, alt. 6400 ft., *Lace 2197* (C).

TIBET FRONTIER: *Younghusband 50* (C).

Distinctive of *P. napaulense* are (1) its large broadly lanceolate leaves, (2) its paniculately well-branched inflorescences with brown tomentum, (3) its sepals, oblong, obtuse, densely ciliate, (4) its ovary, completely pubescent, (5) its capsules 4–8-seeded, and (6) its funicles basal to supra-basal.

Among the Indian species, *P. napaulense* has had a checkered treatment through misidentification. Seeds from a small tree in Nepal were sent to Wallich by Buchanan in 1802. Plants were raised in the Calcutta Botanic Garden. When the plants flowered in 1805, Roxburgh, in Hort. Bengal. 18 (1814) listed them as *Celastrus verticillata*, and in Fl. Ind. **2**: 391 (1824) described the species under that name. In the same year De Candolle (l.c.) described the species as *Senacia napaulensis*. This was later referred to *Pittosporum* by Wight, Prod. **1**: 154 (1834), under *P. floribundum*. Putterlick, Synops. Pitt. 9 (1839), brought *Celastrus verticillata* and *Senacia napaulensis* as synonyms under *P. floribundum*. Hooker's description of the latter, Fl. Brit. Ind. 1: 199 (1872), was based on two specimens, one Wight's *P. floribundum* of South India, and the other *Senacia napaulensis* of the outer Himalayas. Rehder & Wilson (l.c.) separated the latter from true *P. floribundum* and made a new combination, *P. napaulensis*.

Roxburgh characterized his species as bearing "seeds 1–6 or even 8" per capsule, and De Candolle stated, "seeds only 4." Among the Assam material I have examined there are individual specimens which are characterized by capsules with seeds more than 4 and funicles basal to supra-basal. There are also specimens characterized by 4-seeded capsules with basal funicles. Furthermore, there is variation also in the leaves. Most of the specimens bearing capsules with more than 4 seeds are characterized by broadly lanceolate leaves with an acuminate apex; and those bearing 4-seeded capsules have lanceolate leaves with a long-acuminate and pointed apex. However, there are also specimens among the Assam and Nepal plants which are intermediate in their foliar characters. Specimens from Rawalpindi and Dehra Dun bear 4-seeded capsules but have leaves suggestive of those in collections from Assam and Nepal.

41A. **Pittosporum napaulense** var. **rawalpindiense** var. nov.

Frutex vel arbuscula; foliis lanceolatis 9–15 cm. longis, 2–3 cm. latis, apice longe acuminatis; ovario basim versus pubescente; capsula parva 2-valvata, seminibus 4; funiculis 2 basi valvae orientibus.

Leaf-blades lanceolate, 9–15 cm. long, 2–3 cm. wide, long-acuminate and pointed at the apex; ovary pubescent at the base with brown silky hairs; capsules small, 2-valved; valves reflexed after dehiscence; funicles very small, knob-like, only 2 at the base of each valve; seeds only 4 per capsule.

Known at the foot of the Himalayas from Assam to Rawalpindi in northwest Punjab.

PUNJAB: Rawalpindi district, Rajhgharh Reservoir, Dec. 4, 1909, *Parker s. n.* (TYPE, C); Kangra district, Brindarban Reservoir, *Parker s. n.* (C).

DEHRA DUN: Lachiwala, July 1928, *Shivpal s. n.* (A), *Choudhury 8* (A); *Gawal-ud Din s. n.* (A); Sitapani (Ramnager), *Sycl s. n.* (A); alt. 500 m., *Gamble 23281, 25935* (C); Tehri Garwhal, alt. 5000 m., *Gamble 25747* (C); Motra Wala, Dec. 12, 1899, *Mackinnon s. n.* (C).

SIKKIM: Stake, May 1903, *Rik s. n.* (A).

BHOTAN: *Griffith s. n.* (C).

ASSAM: s. l., May 1893, *King s. n.* (C), April 1896, *King s. n.* (A); s. l., *H. B. C. s. n.* (C); alt. 1300 m., Nov. 11, 1875, *215D* (C); *Royle s. n.* (C); Narpur, *Brandis 3029* (C); Bishenpur, alt. 1600 m., *Meeblod 10856* (C).

Distinctive of the variety are its 4-seeded capsules and its lanceolate, long-acuminate leaves. Occurring in the Punjab, it is the most westerly ranging of the Asiatic *Pittospora*.

42. **Pittosporum floribundum** Wight & Arnott, Prod. Fl. Penins. Ind. Orient. 1: 154 (1834); Gamble, Man. Ind. Timb. 43 (1902); Cooke, Fl. Pres. Bombay 1: 58 (1903). — Type: South India, Columale near Nilghiri, *Wight 976*.

Small evergreen tree; bark thin, light greenish grey, conspicuously speckled with lenticels; leaves loosely crowded towards the ends of the branches, thin-coriaceous, glabrous, blades lanceolate to oblong-lanceolate or elliptic-oblong, 6–12 cm. long, 2–4 cm. wide, slightly wavy towards the margin, apex acute, margin entire, petioles slender, 15–20 mm. long; inflorescences terminal to pseudoterminal, much branched, paniculate or paniculately compound-corymbose, slightly pubescent with whitish silky short hairs; pedicels varying in length, glabrous to pubescent with whitish short hairs; flowers numerous and small; flower-buds oblong, 4–5 mm. long; sepals small, 1–2 mm. long, oblong to oblong-ovate, obtuse, glabrous, or pubescent, non-ciliate; petals yellowish, narrow-oblong, 4–5 mm. long; stamens short, slender, filaments 2.5 mm. long, anthers 1 mm. long; ovary densely hairy, very small, 1 mm. long; style glabrous, 1 mm. long; capsules roundish, 6–7 mm. in diameter, slightly compressed, bivalved; valves thin, deeply concave inside, transversely striate; seeds usually 4; funicles short and basal.

Pittosporum floribundum is widely distributed in South India. It has been collected also in Madagascar. It diffuses southward from Chota Nagpur into all the Ghat-forests in peninsular India. The range of its distribution in the Western Ghats reaches only up to Konkan, where, according to Talbot, it is replaced by *P. dasycaulon*.

INDIA: Behar and Orissa, Ranchi district, Oct. 1915, alt. 2000–3000 ft., *Haines 3743* (C); Chota Nagpur, Udaipur, Oct. 1903, *Prain 41* (C); Godavari district, Devanakonda, Oct. 7, 1920, alt. 2500–3000 ft., among rocks, *Marayanaswami 486* (C); Chittoor district, Horsleykonda, May 20, 1921, alt. 4000 ft., *Fischer 4646* (C); Salem district, Hosur, June 16, 1933, alt. 3000 ft., *Yeshoda 615* (A); Madura, Bodimettu Ghat, Dec. 1909, alt. 4000 ft., *Meeblod 13748* (C); Tinnavelly Hills Sengalteri, Feb. 13, 1916, alt. 3000 ft., *Fischer 3898* (C); Travancore, Punniar Valley, Dec. 1909, alt. 4000 ft., *A. Meeblod 13574* (C); Pulney Hills, *Beddome 1858* (C); Lower Pulney, alt. 4000 ft., *Van Malderen 1382* (C); Kodaikanal Region, Pulney Hills, alt. 1000–8000 ft., *Anglade s. n.* (A); Coimbatore, Geddesal, Aug. 31, 1905, alt. 4000 ft., *Fischer 195* (C); Anaimalai Hills, Waterfall, May 24, 1913, alt. 4300 ft., *Fischer 3602* (C); Nilgiris, Bockepuram, Nov. 1884, alt. 3000 ft., *Gamble 15687* (C); Melur, May 1885, alt. 4000 ft., *Gamble 17267* (C); Sigrie Ghat, June 1884, alt. 4000 ft., *Gamble 14514* (C); Gudalur, June 1940, *Barnes 1063* (A); *Wight 976* (TYPE, K; ISOTYPES, A, NY); *Wight 81* (GH); Kadur district, Santaveri, alt. 5000 ft., *Talbot 3057* (C); Koncan, *Law s. n.* (C, GH).

MADAGASCAR: Fort-Dauphin, near Bevilany, Sept. 14, 1928, *Humbert & Swingle 5711* (A).

Pittosporum floribundum is very closely related to *P. kerrii* and *P. napaulense* and intergrades to some extent with them. Some individuals of *P. floribundum* bear leaves which are very similar to those of *P. kerrii*. However, the smaller flowers, the thin-coriaceous leaves, and the paniculate inflorescences pubescent with whitish hairs, are enough to make *P. floribundum* readily recognizable.

I have examined the type and isotypes of *P. floribundum*. They have 4-seeded small capsules; the peduncles and pedicels bear whitish silky hairs, and even the young parts are pubescent. Their inflorescences are not "compact" as mentioned in the original description. Two sheets from Kew bear the number *Wight 976*. One of them is *P. neelgherrense*, which has glabrous peduncles and glabrous pedicels. Wight probably had this in mind when describing the inflorescence of *P. floribundum*. Rehder & Wilson have already pointed out that Hooker's description of the Indian *P. floribundum* was based on two different specimens and have indicated that one represented *P. napaulense* and the other true *P. floribundum*.

There is a specimen which was bought by the Arnold Arboretum from the Boston Society of Natural History. It was by mistake distributed originally as *Wight 476B, Celastrus heyneana*. It is the isotype of this species, *Wight 976* (not *476*).

43. **Pittosporum kerrii** Craib, Kew Bull. Misc. Inf. 16 (1925). — "Types:" Siam, "Doi chiengdao, c. 1800–1900 m., Kerr 5559, 6580."

Tree 4–12 m. tall; young parts brown tomentose; branching verticillate

or forking; bark dark brown, speckled with conspicuous whitish lenticels; leaves crowded towards the ends of the branches, blades glabrous, thick-coriaceous, oblanceolate or oblong-obovate or oblong-elliptic, 6-15 cm. long, 2–5 cm. wide, sometimes undulate towards the margin, apex acute or acuminate, margin entire, slightly recurved, midrib sometimes dividing the blade unequally, areolae very small; petioles usually 15–20 mm. long; inflorescences terminal, much-branched paniculate compound-corymbose, pyramidal, sometimes intercalary, pubescent with short rusty brown hairs; bractlets 4–5 mm. long, deciduous; pedicels very short and varying in length; flower-buds oblong, small, 4–5 mm. long; flowers fragrant; sepals free, glabrous, small, 2–3 mm. long, oblongish or ovate, obtuse or rounded, the margin membranous or ciliate; petals 6 mm. long, golden yellow; filaments 4 mm. long, slender, anthers 1.5–2 mm. long, lanceolate; ovary blackish, base covered with brownish hairs or the whole body hairy; style glabrous, 3 mm. long; capsules 6–8 mm. in diameter, roundish, slightly compressed, bivalved, darkish or brown; valves thin, circular in outline, striate inside, brown; funicles very short, knob-like, usually only 2 at the base of each valve; seeds 4 per capsule, blackish, somewhat reniform, small.

Known from Burma, Yunnan, and northern mountainous parts of Siam and Indo-China.

BURMA: Kalow, May 1932, *Dickason 1219, 1235* (A); Toungye, May 1933, *Dickason 5859* (A); Maymyo, May 1932, *Dickason 5886* (A); alt. 3500 ft., June 18, 1915, *Rodger 148, 152* (C); Jan. 19, 1888, *Prazer 25* (C); alt. 3400 ft., *Kau s. n.* (C); 1888, *Khan 41, s. n.* (C); 1887, *C. B. 413* (C). Maymo plateau, alt. 3500 ft., *Lace 4355, 5284* (C); North Shan States, Lashio, alt. 2600 ft., June 29, 1912, *Lace 5833* (C); Upper Burma, *Khalil s. n.* (A, C).

SIAM: Doi Chieng dao, alt. 1800 m., June 4, 1921, *Kerr s. n.* (K) (small tree about 4 m. high; flowers pale yellow).

INDO-CHINA: Muong Soui, Feb. 8, 1932, *Poilane 20031, 20043* (A).

CHINA: Yunnan: Szemao, alt. 5000 ft., *Henry 12219, 12219B, 12219C, 12219D* (A), *12219E* (A, NY), *12219A* (NY) (tree 15 ft. high, fruits yellow); Mengtze, alt. 4500–5000 ft., *Henry 10041, 10041A* (NY), *10041B* (A, NY) (trees 20–30 ft. high; flowers yellow); Shunning Hila, alt. 1240 m., in forest, *Yü 16378, 16422* (A) (tree 30–40 ft. high; flowers yellowish white); Mienning Chuanla, alt. 1700 m., *Yü 17820* (A) (tree 20–30 ft. high); Nan-Chiao, alt. 1760 m., *Wang 75324* (A) (flowers green); Yang-liao-ying, Cheng-kiang, alt. 1800 m., *Wang 41816* (A) (tree 14 m., 28 cm. diameter, seeds red); Meng-la, Jenn-yeh Hsien, alt. 850 m., *Wang 80753* (A); Shih-ping Hsien, alt. 1600 m., *Tsai 53427* (A) (tree 20 ft.); Lushuei, alt. 1400 m., *Tsai 54546, 55984* (A); near Szemao, March 3, 1922, *Rock 2764* (A) (tree 4.5–6 m. tall); Shweli River drainage basin to summit of Shweli-Salween watershed, east of Tengyueh, Jan. 21, 1923, *Rock 7886* (A); between Kambatti and Tengyueh, via Kuyung, *Rock 7581* (A); west of the Mekong on route from Pingpo to Youngchang and Tengyueh, Salween watershed, Valley of the Mekong, *Rock 6964* (A); on the Shweli-Salween divide, alt. 7000–8000 ft., *Forrest 18382, 18384* (A); s. l., *Forrest 8330, 11589, 11753* (A); s. l., *Forrest 24738* (NY); s. l., *Li 1341, 2944* (A); s. l., *Schneider 2665* (A).

Pittosporum kerrii is very closely related to *P. floribundum* and *P. napaulense* and even intergrades somewhat with them. It differs from them mainly in its area of distribution and in the form and complexity of its inflorescences, and in the shape, size, and texture of its leaves.

44. **Pittosporum johnstonianum** sp. nov.

Frutex vel arbor 4–10 m. alta; foliis lanceolatis vel elliptico-lanceolatis 8–15 cm. longis, 2–5 cm. latis leviter coriaceis glabris, apice longe acuminatis; inflorescentia pseudoterminali laxa composito-umbellata, 25–30 mm. longe pedunculata; floribus ignotis; pedicellis 5–15 mm. longis; capsula 6–7 mm. diametro rotunda; valvis 2 haud crassis orbicularibus; placenta conspicua in parte superiore sterili, funiculis minutis brunneis crassis biseriatis in placenta saepe plus minusve immersis; seminibus numerosis irregularibus parvis atrosanguineis.

Tree or shrub 4–10 m. tall; branching verticillate or forking; bark greyish brown; lenticels on old branches brownish specks, on young branches not evident; leaves loosely crowded towards the ends of the branches, blades thin-coriaceous, glabrous, 8–15 cm. long, 2–5 cm. wide, lanceolate or elliptic-lanceolate, usually acute at the base, tapering, acuminate at the apex, margin entire, slightly recurved, petioles slender, short, 5–15 mm. long; inflorescences pseudoterminal, compound-umbellate, loose, glabrous; peduncles 25–30 mm. long; pedicels 5–15 mm. long; flowers not seen, capsules when fresh yellowish green to brown, when dried blackish or darkish brown, roundish, slightly compressed, small, 6–7 mm. in diameter, 2-valved, valves thin, circular in outline, deeply concave inside, convex outside, inner surface transversely striate, brown; funicles many, brownish, knob-like, distributed in two rows and imbedded in whitish gummy secretion on well-marked placental ridge from the base to or beyond the middle of the placenta, at the apex the placenta infertile; seeds many, irregular, very small, darkish red.

Known from Yunnan and Kwangsi, China, and from northern Burma.

YUNNAN: Kiukiang Valley (Taron), Sronwang, alt. 1500 m., *Yii 20170* (TYPE, A); same valley, south of Kong Pong, alt. 1200 m., *Yii 20463* (A); same valley, Muchietu, alt. 1600 m., *Yii 21017* (A); Chungtien, Lomahua, alt. 2200 m., *Yii 10922* (A); Muli, Guhtzum, alt. 3100 m., *Yii 14825* (A).

KWANGSI: Nee Bai, border of Kweichow, alt. 760 m., *Ching 6307* (NY).

NORTHERN BURMA: Tamai Valley, alt. 1300 m., *Ward 9167* (A).

Distinctive of the species are the loose compound-umbellate inflorescences, the lanceolate or elliptic-lanceolate leaves with a long-acuminate apex, and the distribution of the funicles. It is closely related to *P. daphniphylloides* and *P. adaphniphylloides*, but differs from them in the form and shape of its leaves as well as in the form of the inflorescences.

It is a great pleasure to name this new species in honour of Professor I. M. Johnston, under whose guidance I have worked at the Arnold Arboretum.

45. **Pittosporum adaphniphylloides** Hu & Wang, Bull. Fan Mem. Inst. Biol. n. ser. 1: 101 (1943). — "Types": Szechwan, Opien Hsien, Shaping Shan, *T. H. Chao* [*Choa*] *246*, and *C. W. Yao 2984*.

Pittosporum daphniphylloides sensu Rehder & Wilson, Pl. Wils. 3: 326 (1916).

Shrub or tree 2–8 m. tall; leaves glabrous, thick-coriaceous, alternate along and loosely crowded towards the ends of the branches, blades usually 10–19 cm. long, 4–8 cm. wide, sometimes as much as 35 cm. long, 13 cm. wide, apex sharply acute or acuminate, margin entire, slightly recurved, petioles stout, 2–4 cm. long; inflorescences pseudoterminal, pubescent with brownish short soft hairs, compact, compound-umbellate or paniculately compound-umbellate; peduncles and pedicels covered with appressed short whitish brown hairs varying in length; flower-buds oblong, 5–6 mm. long; sepals unequal, 1–2 mm. long, ovate, acute to obtuse, ciliate; petals yellow, 6–7 mm. long; filaments 5–6 mm. long, anthers sagittiform, 2 mm. long; ovary pubescent, 2–3 mm. long, cylindrical; style glabrous, 3 mm. long; capsules globular, slightly compressed, 6–8 mm. in diameter, 2-valved; valves thin, striate inside, circular in outline; funicles short, knob-like, in two rows from base to or beyond the middle of the placenta; seeds 16–20 per capsule, small, irregular, blackish red.

Known from western Szechwan, from northern Yunnan and Kweichow, China.

SZECHWAN: Wa-shan, alt. 1000 m., *Wilson 1219* (A); s. l., *Wilson 3233* (A); Mt. Omei, *Wilson 4745* (A); Chiuting-shan, alt. 1500 m., *Wilson 1219A* (A); Ping-shan Hsien, alt. 2000 m., *Wang 22806* (A); Mapien Hsien, alt. 1500–1700 m., *Wang 23090* (A); Nanchwan Hsien, *Fang 5822* (A); Hungchunping, alt. 900–1000 m., *Chow 8129* (A).

KWEICHOW: Fan Ching Shan, *Steward, Chiao & Cheo 809* (A, NY); Tinfan, July 19, 1930, *Tsiang 8578* (NY); Yinkiang, Dec. 21, 1930, alt. 400–500 m., *Tsiang 7690, 7756* (NY).

YUNNAN: Ping-pien Hsien, alt. 1500 m., *Tsai 62582* (A).

Pittosporum adaphniphylloides is closely allied to *P. johnstonianum* and *P. daphniphylloides*, but differs from them in its larger leaves and stouter petioles. No other Chinese species has larger leaves. Hu & Wang have given a good description of the species.

46. **Pittosporum daphniphylloides** Hayata, Jour. Coll. Sci. Tokyo 30(1): 34 (1911); Hayata, Icon. Pl. Form. 1: 65 (1911), & 5: 6 (1916); Kanehira, Formosan Trees *248, f. 191* (1936). — Type: Formosa, "Taito, Dakunsha, leg. T. Kawakami et U. Mori, 1906 Dec. (no. 1839)."

Shrub 2–3 m. tall; branching simply forking or verticillate; bark darkish brown, speckled with lenticels; leaves loosely crowded towards the ends of the branches, blades oblong-lanceolate to oblong-oblanceolate, coriaceous, glabrous, 10–18 cm. long, 3–5 cm. wide, apex abruptly acute to acuminate, margin entire, slightly recurved, petioles 1–2 cm. long; inflorescences pseudoterminal, paniculately branched, somewhat compound-

umbellate, compact, densely tomentose with whitish brown short hairs; peduncles 5–10 mm. long; pedicels 2–8 mm. long; flower-buds 5–6 mm. long, 3 mm. thick; sepals ovate, obtuse, glabrous, the margin densely ciliate with short brownish hairs; petals 7 mm. long; filaments 5 mm. long, anthers 2 mm. long; ovary pubescent, 2.5 mm. long, obovoid; style glabrous, 2 mm. long; capsules small, globular, 6 mm. in diameter, 2-valved; valves thin, circular in outline, transversely striate inside; funicles very small, knob-like, distributed from the base of the valve to or beyond the middle of the placenta; seeds 10–15 per capsule, small, irregular.

Known from Formosa.

FORMOSA: Arisan, Dec. 1914, alt. 2500 ft., *Faurie 1114 s. n.* (A); Kagi, alt. 2166–2333 m., *Wilson 9705, 10803* (A); Daidakusui-kei, *Mori 73* (A).

Pittosporum daphniphylloides very closely resembles *P. johnstonianum*, but the latter differs in having smaller leaves with long acuminate apex and also a loose and long-peduncled inflorescence. This species bears also a very close resemblance to *P. adaphniphylloides;* the latter, however, has large leaves.

47. **Pittosporum tetraspermum** Wight & Arnott, Prod. Fl. Penins. Ind. Orient. **1:** 154 (1834); Wight, Icon. Pl. Ind. Orient 3(3): 6, *t. 971* (1845); Wight, Spicilegium Neilgher. **1:** 37, *t. 43* (1846); Beddome, Fl. Sylv. **2:** (Forester's Man. Bot. xvii, *t. 2, fig. 8*) (1874); Fyson, Fl. South Ind. Hill Stat. **1:** 31, & **2:** *f. 20* (1932). — Type: *Wight 142,* from South India.

Pittosporum tonkinense Gagnepain, Bull. Soc. Bot. France **55:** 547 (1908). — Type: Indo-China, Tonkin, Mt. Dongang, Feb. 1886, *Balansa 1416.*

Shrub or small tree, branching simple or verticillate; bark brown or greyish, speckled with conspicuous whitish lenticels; leaves crowded towards the ends of the branches, blades elliptic, elliptic-lanceolate, or elliptic-oblong or obovate, 5–8 cm. long, 2–4 cm. wide, coriaceous, glabrous, apex acute to acuminate, sometimes obtuse; margin entire, petioles 5–10 mm. long; inflorescences pseudoterminal, umbellate or subumbellate, pubescent; pedicels short; flower-buds oblong, 8–10 mm. long; sepals pubescent, 2–3 mm. long, ovate to lanceolate, acuminate; petals linear-oblong, 9–10 mm. long; ovary brown-tomentose; ovules 4 per ovary; capsules globular, small, slightly compressed, 6–9 mm. in diameter, 2-valved; valves thin, striate inside; funicles small, only 2 at the base of each valve; seeds 4 per capsule, darkish red, somewhat reniform.

A widely distributed species in South India. It is know also from Ceylon, Tonkin, Indo-China, and Kwangsi, China.

INDIA: Chota Nagpur, Nov. 1875, *Wood 187* (C); Nilgiris, Dodabetta, alt. 8000 ft., April 1882, *Brandis 896* (A, C), alt. 7500 ft., Oct. 1883, *Gamble 13142* (C); Nilgiri Hills, *Wight 79* (GH, C), *Wight 80* (GH); Ootacamund, Oct. 17, 1921, *Wilson s. n.* (A) (small tree, 50 ft.); same locality, Aug. 10, 1878, *King s. n.* (C); Ooty, March 20, 1870, *Clarke*

11140 (C); Pykarah, *Meeblod 11849* (C), same locality, alt. 6500 ft., June 1883, *Gamble 11988* (C); same locality, *King s. n.* (C); Coonoor, Oct. 1910, alt. 5000 ft., *Meeblod 11803* (C); Travancore, Devicolam, Dec. 1909, alt. 6000–7000 ft., *Meeblod 13476, 13477* (C); Tinnavelly Hills, *Sibpur Bot. Gard. Herb. 34159* (C); Anaibetta, March 21, 1886, *Fischer 883* (C); Kodai Kanal, alt. 7000 ft., *Maideren 1400* (C).

KWANGSI: Nam Tanyuen, *Wang 40908* (A); Chen Pien district, *Ko 56093* (A); Ling Wun, *Lau 28759* (A); Tia Lian Shan, Luchen, N. Kwangsi, alt. 1800 ft., *Ching 5309* (A); Moo Shan, Luchen, alt. 1800 ft., *Ching 5364, 5400* (A).

KWEICHOW: Tungtze, alt. 450 m., *Tsiang 5101A* (NY).

Pittosporum tetraspermum is a variable species. The shape and size of the leaves vary greatly; and to a certain extent the size of the capsules also varies. The leaves on the specimens from Kwangsi are slightly glossy as compared to those from India, but otherwise the plants agree very well. Unfortunately I have not seen any specimens of *P. tonkinense*, but judging from the description I cannot believe that *P. tonkinense* is different from *P. tetraspermum*.

Its seed number (4 seeds per capsule) and its simple inflorescences (simple umbel or subumbellate) are characters which serve to separate *P. tetraspermum* from other members of the BIVALVAE in our area. It closely resembles *P. neelgherrense*, but the latter is quite distinct in having ovate flower-buds and somewhat woody capsules. *Pittosporum tetraspermum* becomes a large shrub or small tree and in India flowers in February to March.

48. **Pittosporum leptosepalum** sp. nov.

Arbuscula 3 m. alta; foliis elliptico-lanceolatis, 3–9 cm. longis, 1.5–3 cm. latis, tenuiter coriaceis glabris; inflorescentia pseudoterminali uni- vel pauci-flora umbellata glabra; pedicellis gracilibus 5–12 mm. longis glabris; floribus in alabastro oblongis 6–8 mm. longis; sepalis liberis glabris 4–5 mm. longis anguste lanceolatis acuminatis inconspicue ciliatis vel eciliatis; petalis 7–9 mm. longis; ovario pubescente; capsula globulari 6–8 mm. diametro; valvis tenuibus 2, circularibus; placenta supra medium sterili; funiculis minutis; seminibus 10 parvis irregularibus atro-sanguineis.

Small tree 3 m. tall; branching verticillate or forking; bark greyish or brown, speckled with evident lenticels; leaves glabrous, loosely crowded towards the ends of the branches, blades elliptic-lanceolate, usually broader at the middle and tapering at both ends, 3–9 cm. long, 1.5–3 cm. wide, slightly wavy towards the margin, thin-coriaceous, apex acuminate, margin entire, slightly recurved; petioles 5–15 cm. long, inflorescences few-flowered umbels or single flowers, pseudoterminal, glabrous, subtended by 3 or more leaves and bracts at the base; bracts membranous, glabrous; pedicels slender, 5–12 mm. long, glabrous; flower-buds oblong, 6–8 mm. long; sepals free, narrowly lanceolate, acuminate, 4–5 mm. long, inconspicuously ciliate or non-ciliate; petals 7–9 mm. long; filaments 5–6 mm. long, anthers 1.5 mm. long; ovary 3 mm. long, hairy, cylindrical,

with definite stipe; style glabrous, 3 mm. long; stigma slightly capitate; capsules small, globular, 6–8 mm. in diameter, 2-valved; valves thin, deeply concave inside, striate and coated with oily substance, brown, circular in outline; funicles very small, confined to the basal and supra-basal part of the placenta; seeds 10 or more, small, irregular, coated with oily substance, darkish red.

Known from Kwangsi and Kwangtung, China.

KWANGSI: Shuen-yuen, *Z. S. Chung 81567* (TYPE, A); Sanmin Village and vicinity, *Tsang 27960* (A); Lung-mu-an and vicinity, *Tsang 27799* (A); Shap Man Taai Shan, *Tsang 23876* (A).

KWANGTUNG: Yang Shan and vicinity, *Tsui 442* (A); Tan Hsia Shan, *Chun 5566* (A); Lienchow River, Aug. 16, 1887, *Ford 1791* (A).

Pittosporum leptosepalum, though closely resembling *P. pauciflorum* in its vegetative characters, can at once be distinguished from the latter by its small bivalved globular capsules. The diagnostic features of the species are its free, narrow, lanceolate, long sepals (4–5 mm.), its small globular bivalved capsules, and its elliptic-lanceolate leaves.

49. **Pittosporum truncatum** Pritzel, Bot. Jahrb. **29:** 378 (1900); Rehder & Wilson, Pl. Wils. 3: 328 (1916). — "Types": Szechwan, *Bock von Rosthorn 2071;* Tahokou Abhange, *Bock von Rosthorn 150;* Yang Yu Ping, *Bock von Rosthorn 69.*

Shrub 1–3 m. tall; branching verticillate or forking; bark brownish or greyish, speckled with lenticels; leaves crowded towards the ends of the branches, coriaceous, glabrous, sometimes young leaves and young petioles pilose with whitish short hairs; blades 2.5–9 cm. long, 1.5–4 cm. wide, rhombic-obovate, alternate at the base, very abruptly acuminate at the apex, rarely obovate with acute or acuminate apex, margin entire, slightly recurved, petioles usually 5 mm. long, rarely 10–15 mm. long; inflorescences pseudoterminal, umbellate or subumbellate, bracteate at the base, slightly pubescent; bracts brownish, persistent, glabrous or pubescent, ovate, obtuse; bractlets lanceolate, 5 mm. long, membranous, glabrous or pubescent; flower-buds oblong, 6–7 mm. long; sepals glabrous, unequal, 2–3 mm. long, slightly connate at the base, ovate or lanceolate, obtuse or acute, ciliate or non-ciliate; petals 8–10 mm. long; filaments 5–6 mm. long, anthers oblong, 1.5–2 mm. long; ovary pubescent, obovoid or cylindrical, 3 mm. long; style glabrous, 4 mm. long; capsules globular, slightly compressed, small, 6–8 mm. in diameter, borne in a cluster, rarely solitary, bivalved; valves thin, circular or nearly circular in outline, inner surface striate, placental ridge thick and raised at the base of the valve, gradually tapering towards the apex; funicles inconspicuous, distributed from the base to or beyond the middle of the placenta; seeds 10–15 per capsule, rarely 20, irregular, blackish red or pink.

Known from Central China, ranging from western Hupeh through southern Shensi to the whole of the Yangtze drainage in Szechwan.

HUPEH: Ichang, *Wilson 650* (A); Chienshih Hsien, *Chow 1555* (A);

Gian Gia Kow, alt. 700 m., *Chun 3601* (A); near Bo Moh Pung, *Chun 3568* (A); s. l., *Wilson 51* (A); s. l., *Henry 7306* (A).

SHENSI: Tsinling Shan, *Fenzel 539* (A).

SZECHWAN: Nanchwan, *Bock von Rosthorn 2071* (A, type collection); same locality, *Wang 155* (A); Kwang-yun Hsien and vicinity, alt. 1100 m., *Wang 22615* (A); banks of Yangtze River, Wan Hsien, *Wilson 3178* (A); Kai Hsien, *Fang 10114* (A).

Pittosporum truncatum is very closely related to *P. heterophyllum* and intergrades with it. It differs, however, in the shape and size of its monomorphic leaves. Rehder & Wilson included *P. brevicalyx* (Oliv.) Gagnep. as a synonym of *P. truncatum*. With this I cannot agree. The rhombic-ovate and very abruptly acuminate leaves and the simple pseudoterminal inflorescences of *P. truncatum* are in complete contrast to the oblanceolate to obovate-lanceolate leaves and well-branched terminal paniculate inflorescences of *P. brevicalyx*.

49A. **Pittosporum truncatum** var. **tsaii** var. nov.

Frutex 3 m. altus; foliis rotundo-obovatis vel obovatis plus minusve lobulatis apice obtusis vel acutis; floribus solitariis.

YUNNAN: Lan-ping Hsien, alt. 2700 m., *Tsai 56075* (TYPE, A), *Tsai 57073, 57134* (A).

50. **Pittosporum oblongilimbum** Merrill, Jour. Arnold Arb. 19: 33 (1938). — Type: Indo-China, Tonkin, Chapa, alt. 1500 m., April 1936, *Pételot 5937*.

Tree; branching verticillate or forking; bark greyish or brown, speckled with lenticels; leaves alternate along and loosely crowded towards the ends of the branches, blades narrow-lanceolate, sometimes strap-shaped, 10–19 cm. long, 2–3 cm. wide, 4–6 times as long as broad, glabrous, coriaceous, apex acuminate, sometimes abruptly acuminate to acute, margin entire, slightly recurved, petioles 5–10 mm. long; inflorescences pseudoterminal or terminal on the young shoot, subumbellate, glabrous, subtended by bracts at the base; pedicels varying in length, 6–20 mm. long, glabrous; flower-buds oblong, 10–11 mm. long; sepals connate at the base, 4–5 mm. long, glabrous, oblong or oblong-ovate, obtuse or acute; petals 14 mm. long; filaments 8–10 mm. long; anthers 3 mm. long; ovary pubescent, 5 mm. long, 2-carpelled; ovules 6 per ovary; capsules not seen.

Known from Tonkin, Indo-China.

INDO-CHINA: Tonkin, Chapa, *Pételot 5937* (A, TYPE).

Distinctive of the species are its narrow, strap-shaped, long leaves, its bicarpelled ovary, its long glabrous sepals, and its large flowers. The type is no. *5937*, not "5947" as published.

51. **Pittosporum pulchrum** Gagnepain, Bull. Soc. Bot. France 8: 546 (1908); Fl. Gén. Indo-Chine 1: *t. 18* (1909). — "Types": Indo-China, Tonkin, Mt. Lan-mat, March 15, 1889 and June 1890, *Bon 4097, 4099*, and *4373*.

Shrub; branching verticillate or forking; bark grey, speckled with lenticels; leaves small, loosely crowded towards the ends of the branches, blades narrowly oblanceolate, tapering at the base, obtuse and apiculate at the apex, 20–40 mm. long, 7–15 mm. wide, coriaceous, glabrous, margin entire, slightly recurved, petioles 3–10 mm. long, slender; inflorescences terminal, corymbose, pilose, subtended by leaves at the base; pedicels 10–15 mm. long; sepals dorsally pilose, unequal, elliptic to oblong, rounded at the apex, ciliate; petals white, linear with obtuse apex; ovary hairy, cylindrical, bicarpelled; ovules 6–8 on each placenta, biseriate; capsules globular, slightly compressed, small, 6–8 mm. in diameter, 2-valved; valves thin, circular in outline, striate and brown inside; funicles very short, biseriate, distributed from the base of the valve to or just below the middle of the placenta, the placenta above the middle infertile; seeds 10–14, small, irregular, darkish pink.

INDO-CHINA: Tonkin, Lan-mat, June 1890, *Bon 4373* (A, type collection).

Pittosporum pulchrum is a very distinctive member of the small-capsuled BIVALVAE. It is readily recognized by its terminal corymbose inflorescences and by its narrow-oblanceolate leaves. It is very closely allied to *P. humile,* but the latter is characterized by narrow-lanceolate leaves and glabrous ovary.

51A. **Pittosporum pulchrum** var. **foliosum** Gagnepain, Bull. Soc. Bot. France 8: 547. 1908. — "Types": Indo-China, Tonkin, Mt. Dongham, March 16, 1883, Mt. Ban-phet, Nov. 1883, and Mt. Lan-mat and Lat-son, April 1883, *Bon 1997, 2323,* and *2032.*

I have seen no specimen pertaining to this variety. According to Gagnepain, it differs from the species in having a shorter inflorescence.

52. **Pittosporum heterophyllum** Franchet, Bull. Soc. Bot. France 33: 415 (1886); Franchet, Pl. Delavay. 76, *t. 18* (1889); Rehder & Wilson, Pl. Wils. 3: 329 (1916). — "Types": "Yunnan, ad sepes in montibus calcareis, v. c. in faucibus montis Pee-cha-ho, prope Mo-so-yn, alt. 2200 m.; fl. 23 April., fr. 30 Aug. 1884 (Delav. n. 794, 816 et 965)."

Shrub 1–4 m. tall; young parts pilose with appressed whitish short hairs; leaves heteromorphous, varying in size, blades lanceolate or ovate-lanceolate or obovate and abruptly acute, 20–80 mm. long, 5–25 mm. wide, coriaceous, glabrous, apex acute to obtuse and apiculate, margin entire, petioles (0–)2–5 mm. long; inflorescences pseudoterminal, umbellate or subumbellate, pubescent; pedicels 5–10 mm. long; flowers fragrant; sepals unequal, membranous, lanceolate or deltoid, 1–3 mm. long, ciliate; petals oblongish, 10 mm. long; filaments 5–6 mm. long; anthers 1.5–2 mm. long; ovary pubescent; capsules yellowish brown, globular, small, 6–8 mm. thick, slightly compressed, 2-valved; valves thin, circular in outline, inside striate; funicles very small, knob-like, basal to suprabasal; seeds 5–8 per capsule, small, irregular, blackish red.

Known from Yunnan, Szechwan, and Sikang. Most collections, however, come from Yunnan.

YUNNAN: Eastern slopes of Likiang Snow Range, *Rock 3633, 3910* (A); north of Chungtien, Tonwa Territory, alt. 4000 m., *Rock 24714* (A); near Ngaza, west of Likiang, *Rock 8478* (A); west slopes of Likiang Snow Range, *Rock 4189* (A); Chien Chuan, *Rock 6536* (A); mountains south of Likiang, Sungkwe Hochin Range, *Rock 8316* (A); Mt. Mitzunga, Muli Territory, *Rock 24522* (A); Likiang Range, alt. 3000 m., *Forrest 2084* (A); s. l., *Yü 10443, 11072* (A); Chungtien Haba, alt. 2400 m., *Yü 13544* (A); Muli Wachin Shawan, alt. 2900 m., *Yü 14489* (A); Muli Wachin, alt. 3000 m., *Yü 14382* (A); Atuntze, Mt. Kaakerpu, alt. 2800 m., *Yü 10311* (A); Atuntze, Hungpoh, *Yü 7982* (A); Sikang, Shiangcheng, alt. 3000 m., *Yü 13409* (A); Wei-si Hsien, Yeh-chih, alt. 2000 m., *Wang 70385* (A); Likiang Hsien, alt. 2300 m., *Wang 71523* (A); Likiang, *Ching 20153* (A); east Likiang, *Ching 21688* (A); Likiang Laschiba, *Ching 20313* (A); Ganhaitze, southwest of Likiang Snow Range, *Ching 21737* (A); Likiang, alt. 2800 m., *Schneider 3066* (A); Yong-shan Hsien, alt. 800 m., *Tsai 51224* (A); Lan-ping Hsien, alt. 2400 m., *Tsai 56634* (A); Lan-ping Hsien, alt. 3000 m., *Tsai 56280* (A); Yunpe, alt. 1–2 m., *Ten 326* (A); Kouty, alt. 2 m., *Ten 437* (A); east Chungtien, *Feng 2455* (A); Likiang, *Feng 606* (A); open situations among boulders on the Mekong-Salween divide, alt. 9000–10000 ft., *Forrest 14994* (A); s. l., *Forrest 10000, 10303, 10915, 11335* (A).

SZECHWAN: Ya-chow Fu, *Wilson 3179* (A); Wen Chuan Hsien, alt. 1000 m., *Wilson 1146* (A); north of Wen-chuan Hsien, alt. 2000 m., *Wang 21789* (A); Mt. Omei, alt. 900 m., *Yü 572* (A); s. l., *Smith 4890* (A); s. l., *Schneider 1346, 4090* (A); Luting-hsien Luting Kiao, *Fang 3723* (A); *E. Drake s. n.* (A).

SIKANG: Chi-na-tung, Tsa-wa-rung, alt. 2800 m., *Wang 65170* (A); Me-kong, Tsa-wa-rung, alt. 2600 m., *Wang 65478* (A); Dzer-nar, Tsa-wa-rung, alt. 2500 m., *Wang 65438* (A); s. l., *Chiao 1314* (A).

Pittosporum heterophyllum is very closely allied to *P. truncatum* and intergrades with it. It differs, however, in having usually smaller and narrower heteromorphous leaves.

52A. **Pittosporum heterophyllum** var. **sessile** var. nov.

Frutex prostratus; foliis sessilibus anguste lanceolatis basim versus latioribus 30–70 mm. longis, 5–8 mm. latis, apice acuminatis et apiculatis; ovario glabro.

Prostrate shrub; leaves sessile, narrowly lanceolate, broadest at the base and gradually tapering to an acuminate apex, apiculate; peduncles and pedicels densely tomentose; ovary glabrous.

YUNNAN: To Ty Ho, *Ten 383* (TYPE, A).

This variety differs from both *P. heterophyllum* and *P. saxicola* in the glabrous ovary, the tomentose inflorescence, and the sessile leaves.

53. **Pittosporum saxicola** Rehder & Wilson, Pl. Wils. 3: 329. 1916.—"Types": western Szechwan, near Mao-chou, valley of Min River, alt. 1300–1800 m., *Wilson 3182* & *3230*.

Low prostrate shrub 0.3–2 m. tall; bark grey; leaves extremely small and narrow, subsessile, blades 20–35 mm. long, 3–9 mm. wide, narrow-oblong or elliptic-oblong, apex obtuse and apiculate, margin entire and slightly recurved, petioles 0–5 mm. long; inflorescences terminal or pseudo-terminal, on axillary short or long branches, single-flowered or few-flowered, umbellate or subumbellate, slightly pubescent; pedicels 3–8 mm. long; flower-buds oblong, 5–6 mm. long; flowers fragrant, polygamo-dioecious; sepals free, ovate, acute or obtuse, 2–3 mm. long, ciliate; petals 7–8 mm. long; filaments 4–4.5 mm. long; ovary slightly pubescent; capsules globose, slightly compressed, 6–8 mm. in diameter, 2-valved; valves thin, circular in outline; funicles very small, knob-like, distributed from the base to the middle of the placenta; seeds 8–10 per capsule, very small, pinkish black, irregular.

WESTERN SZECHWAN: near Mao-chou, alt. 1000–1800 m., *Wilson 3182* (A, TYPE; fl.), *3230* (A, TYPE; fr.), *3232* (A); Tsing-chuan-fin Hsien, alt. 1100 m., *Wang s. n.* (A).

The specimen *Wilson 3232* bears flowers with short stamens; the filaments hardly surpass the body of the ovary, and the anthers are poorly developed.

Pittosporum saxicola is very closely related to *P. heterophyllum* but differs from it in having extremely narrow and small leaves. It is said to be common in rocky places in arid parts of the valley of the Min River. It forms low scrub, with stems prostrate on the ground.

THE ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

STUDIES IN THE BORAGINACEAE, XXI
SINO-INDIAN SPECIES OF ONOSMA

IVAN M. JOHNSTON

Continued from page 225

19. **Onosma Waddellii** Duthie, Kew Bull. **1912**: 41 (1912). — Type from Lhasa, Tibet, ca. 3650 m. alt., *Waddell*.

Plant with one to several slender stems arising from a slender dye-stained root, annual or biennial or sometimes perennial; stems erect to decumbent, 1–3 dm. long, 1–3 mm. thick towards the base, simple or more commonly bearing slender ascending floriferous branchlets (1–8 cm. long) at least above middle, at times with pedunculate cymes in many of the leaf-axils, sparsely hispid (hairs ca. 1 mm. long, stiff, spreading, from thickened base) and abundantly strigulose (hairs 0.1–0.2 mm. long, mostly closely appressed, mainly retrorse); leaves numerous, veinless, green above, strigulose and with scattered appressed coarse hairs with evident pallid bases, lower surface paler, abundantly strigulose; basal leaves usually not persistent at flowering time, narrowly oblanceolate, about 4–6 cm. long; middle stem leaves lanceolate, 2–5 cm. long, 4–7 mm. broad; cymes usually numerous, terminating stems and branches and frequently pedunculate in the upper axils, not forked, at anthesis 1–1.5 cm. broad, at maturity becoming racemose, 4–7 cm. long; peduncles slender, sparsely leafy, 3–5 cm. long; calyx 5–7 mm. long, weakly accrescent at maturity, lobes lanceolate, 0.5–1 mm. broad, short hispid; pedicels 1–3(–5) mm. long; corolla blue, 10–15 mm. long, with a short tube ca. 2 mm. thick then expanding into a campanulate throat 5–8 mm. broad, outside inconspicuously strigulose or hispidulous on and directly below the lobes, elsewhere usually obscurely puberulent, inside glabrous except for the usually villose nectary; lobes triangular, 2.5 mm. broad, 1–1.5 mm. long, margin revolute; throat outside moderately inflexed below the corolla-sinus; anthers 4–7 mm. long, coherent at base and sides to form a tube, partially to nearly completely exserted, affixed 1.5 mm. above base, base carried 2–5 mm. below level of corolla-sinus, sterile tips 0.5–1 mm. long; filaments 5–7 mm. long, arising 3–4 mm. above corolla-base, decurrent base 2.5–3 mm. long, becoming swollen when moistened, frequently minutely papillate; nectary very narrow, 0.1 mm. high, lobulate, more or less villulose; style glabrous, 10–16 mm. long; nutlets 2.5 mm. long, somewhat lustrous, sparsely tuberculate and obscurely rugulose.

TIBET: Lhasa, 12000 ft., Sept. 1904, *Waddell* (Ed, G, ISOTYPES); Lhasa, 12000 ft., open sandy banks, fl. clear bright blue, *Ludlow & Sherriff 9738* (G); near Drepung Monastery, Lhasa, 12000 ft., gravelly soil, fl. bright sky-blue, *Ludlow & Sherriff 9000* (G); Singma Khangchung, 11500 ft., *F. S. Chapman 190* (Ed); Lilung, Tsangpo Valley, long. 93°54′, 10000 ft., open grassy meadow, fl. very bright blue, *Ludlow, Sherriff & Taylor 5702*

(G); Tumnyen, long. 94°38′, common down Tsangpo Valley in sandy gravelly or dry places, fl. deep blue, 9500 ft., *Ludlow, Sherriff & Taylor 5469* (G); Gyala, Tsangpo Valley, long. 94°56′, 9300 ft., *Ludlow, Sherriff & Taylor 7547* (G); Gyala, gorge of Tsangpo, 9000 ft., rocky open situations by river, very sandy soil, fl. sky blue, *Ward 5965* (Ed, K); without locality, 1884, *King's collector 363* (DD).

19A. **Onosma Waddellii** var. **brachylinum**, var. nov.

A varietate genuina differt filamentis conspicue brevioribus 2–3 mm. longis.

TIBET: Kharta Valley, stony ground, 11500 ft., fl. deep blue, July 3, 1922, *E. F. Norton 312* (TYPE, Kew); Arun Valley, stony ground, 11000 ft., fl. pink, July 3, 1922, *E. F. Norton 305* (K); Orpa near Kharta Shika, 11000 ft., July 7, 1923, *L. R. Wager* (K); north of Mt. Everest, 12–16000 ft., Aug. 1921, *A. F. R. Wallaston 229, 231,* and *232* (K).

Onosma Waddellii is a well-marked species. In general appearance it most suggests *O. multiramosum, O. adenopus* and *O. Farrerii,* and probably has some relations with them. Compared with the latter *O. Waddellii* differs in its ample corolla with coarser lobes and less strongly pleated throat. The corolla also has a thinner texture and its outer surface has a distinctive very minute puberulence. The folded corolla in the mature flower-bud is noticeably stouter and less attenuate apically than in the species mentioned.

The variety *brachylinum* comes from the northern base of Mt. Everest and accordingly from a part of Tibet to the southwest of that in which typical *O. Waddellii* is known. It differs from the typical variety not only in its very short filaments (2–3 mm., not 5–7 mm. long), but also in a number of less precise details. Noteworthy are its more spreading, frequently rather tawny, rather than pallid hairs, its proportionately broader leaves, and its slightly coarser cymes. These combine to make the variety *brachylinum,* as compared with var. *typicum,* appear slightly coarser, darker in color, and perceptibly less smooth and tidy in general appearance. Examination under the microscope reveals differences in the indument on the exterior surface of the corolla. The corolla of var. *brachylinum* is more abundantly and evidently puberulent, but less hispidulous than in *typicum.* The two also show differences in the degree to which the anthers may protrude from the corolla. The anthers are wholly included or have only their tips exserted in var. *brachylinum.* In var. *typicum* the anthers are exserted usually for at least half their length.

20. **Onosma Farrerii,** sp. nov.

Planta cinerea fruticulosa radice et basi caulis ignota, fortasse perennis et laxe ramosa; ramis hornotinis gracilibus foliosis simplicibus vel apicem versus ramulis paucis brevibus floriferis donatis, 2–3 dm. longis basim versus ca. 2 mm. crassis, hispida (pilis rigidis robustulis adscendentibus vix abundantibus 0.5–1.3 mm. longis basi discoidea orientibus) et strigulosis (pilulis 0.1–0.2 mm. longis retrorsis); foliis 1.5–3 cm. longis 2–4 mm. latis oblanceolatis enervatis scabris, in facie superiore hispidis (pilis adscendentibus rigidis 0.5–1 mm. longis basi discoidea orientibus) et

abundante strigulosis; in facie inferiore abundanter strigulosis; cymis 1–2 cm. latis, maturitate ad 4 cm. longis; calyce subanthesi ca. 6 mm. longo, lobis 0.5–1 mm. latis, pedicello ad 6 mm. longo; corolla in alabastro rostrato-attenuata apicem versus obscure curvata; corolla sub anthesi 11–11.5 mm. longa coerulea, a basi 2–2.5 mm. crassa primo laeviter deinde (ca. 2.5 mm. supra basim) validioriter ampliata, sinus versus 3–5 mm. crassa, sub sinus supra medium plicata, extus antrorse strigulosis et minutissime puberulenta, intus (nectario excepto) glaberrima; antheris 8 mm. longis basaliter lateraliterque cohaerentibus tubum formantibus, 1–1.5 mm. supra basim affixis, apicibus sterilibus ca. 1 mm. longis, basibus 1–2 mm. infra sinus corollae positis; filamentis 7 mm. longis a basi 0.3–0.5 mm. lata sursum gradatim attenuatis, 3 mm. supra basim corollae orientibus, transverse arcuateque affixis, haud decurrentibus; nectario angustissimo lobulato villuloso ca. 0.1 mm. alto; stylo glabro 13–15 mm. longo; nuculis ignotis.

CHINA (southern Kansu): betw. Kiai Chow and Wen Hsien, very abundant on dry bank, Apr. 26, 1914, *R. Farrer 3* (TYPE, Gray Herb.).

This species comes from southernmost Kansu and there, at about lat. 33°, sets the northern limit for the genus in China. It appears to be related to *O. sinicum*, which ranges south of it, but is quickly separated by having the inner surface of the corolla and the filaments glabrous. Farrer, Jour. R. Hort. Soc. **42**: 87 (1916) gives the following field notes concerning the type collection: "It fills all the torrid banks, in the torrid region of the Blackwater and the Nan Ho, with low clumped masses of narrow gray foliage, from which, in April, unfurl croziers of long pale-blue bugles, very pretty, but not large enough, and with the unfortunate notion of attempting a copy, at all points, of the supreme and inimitable *Lithospermum graminifolium*."

21. **Onosma Thomsoni** Clarke, Fl. Brit. India 4: 178 (1883). — Type from Banahal, southern Kashmir, 6000 ft., *Thomson* ("Onosma no. 3").

Plant perennial, producing numerous somewhat fruticulose stems from a small loosely branched persisting fruticose caudex; stems of the year leafy, erect or ascending, 1.5–5 dm. long, 2–3 mm. thick towards base, simple or producing more or less elongate ascending leafy branches, abundantly villose or villose-hispid (hairs spreading 1–3 mm. long, white, slender); leaves numerous firm, veinless, frequently with strongly revolute margins, upper surface green, sparsely hispid (hairs pungent, stiff, usually ascending, arising from large white disks) and scantily strigulose (hairs 0.1–0.2 mm. long), lower surface white, minutely villulose or strigulose (hairs 0.1–0.2 mm. long) and also abundantly villose (hairs 1–2 mm. long); leaves towards base of stem oblanceolate, as much as 5–10 cm. long and 5–10 mm. broad, acute; middle cauline leaves usually narrowly lanceolate, 2–5 cm. long, 2–9 mm. broad; cymes 1.5–3 cm. broad at anthesis, at maturity loosely racemose and 4–9 cm. long, frequently forked, terminating

the main stems and branches and occasionally arising on peduncles 2–3 cm. long from the uppermost leaf-axils; calyx 8–11 mm. long, lobes lanceolate, densely villose or villose-hispid, pedicels 1–3 mm. long at anthesis, becoming 3–10 mm. long at maturity; corolla 10.5–12 mm. long, narrow, from a short tube 2–2.5 mm. thick expanding into an elongate throat 3–4.5 mm. thick, outside abundantly but minutely strigulose with mostly retrorse hairs, inside glabrous except for the nectaries, throat narrowly and tightly infolded below each corolla-sinus, lobes triangular 1.5 mm. broad, 1 mm. long, tip loosely recurved; anthers 7–8.5 mm. long, united into a tube, long exserted, affixed 1.5–2.2 mm. above base, sterile tips 1–2 mm. long, base carried 1.5–3 mm. below level of corolla-sinus; filaments 6–7 mm. long, arising 3–3.5(–4) mm. above corolla base, subulate, broadened near the base, attached transversely and arcuately, not at all decurrent; nectary very narrow, lobulate, ca. 0.1 mm. high, villulose; style 12–17 mm. long, glabrous; nutlets 2.5–3.5 mm. long, lustrous, obscurely rugulose or nearly smooth.

Known only from northwestern India; ranging in the front ranges of the Himalayas from Garhwal (long. 78°30′) to Hazara (long. 73°30′), from 3000 to 7000 ft. alt.

INDIA: Kalansa, Jaunsar, 5000 ft., May 1896, *J. S. Gamble 25771* (DD); rocks in Tons Valley, Jaunsar, above Thudyar, 3000–4000 ft., May 4, 1895, *Duthie 15569* (DD); Chakrata Hills, Bodyar-Simla road, 7500 ft., fl. white, May 29, 1936, *C. E. Parkinson 7020* (DD); Bassahir, *J. R. Drummond 26013* (Ed); Tons Valley, Tehri-Garhwal, rocks, 3000–4000 ft., May 12, 1897, and May 22, 1900, *Duthie 19804* and *23934* (DD); Karole, Tons valley, 3000 ft., May 1895, *J. S. Gamble 25420* (DD); Kagan Valley, Hazara, 7000 ft., May 13, 1896, *Inayat 19479* (DD); Jabori, Saran range, Hazara, Aug. 1896, *Inayat* (DD); Kawai, Hazara, May 19, 1897,—no. *22013* (DD); Dhanni to Tithwal, lower Kishenganga Valley, Kashmir, ca. 3000 ft., *R. R. Stewart 17371* (G); ["Bahahal, Kashmir"], 5000–7000 ft., *T. Thomson 3* (G, ISOTYPE).

I can suggest no very close relative for this very well marked species. In the transverse arcuate attachment of its filaments it resembles *O. Farrerii,* but is no more closely related to that species than to *O. hypoleucum,* the Indian species so long confused with it.

22. **Onosma bracteatum** Wallich in Roxburgh, Fl. Indica, ed. Carey, **2:** 13 (1824); DC. Prodr. **10:** 66 (1846); Wallich, Numerical List 26, sub no. 936 (1829); Clarke, Fl. Brit. India **4:** 178 (1883).—Type from "Shree-nugur" [Srinagar, Kumaon], *Kamroop.*

Onosma macrocephala D. Don, Prodr. Fl. Nepal. 99 (1825) and Gen. Syst. **4:** 316 (1838).—A renaming of *O. bracteatum* Wall.

Perennial with several simple stems arising from a coarse persisting cluster of basal leaves; herbage coarsely villose-hispid and also minutely villulose, coarse hairs moderately stiff 1.5–4 mm. long, mostly arising from thickened bases, frequently somewhat tawny, short hairs straight, spreading or retrorse, 0.2–0.6 mm. long; stems 3–5 dm. tall, becoming 4–6 mm. thick,

leafy; leaves usually with some evident veins, the upper surface green, hispid, and scantily villulose, the coarse hairs with conspicuous pallid bases, the lower surface with a pallid villulose indument, scantily hispid; basal leaves persisting at anthesis, 12–30 cm. long (including the winged petiole 3–4 mm. wide and 6–8 cm. long), blade 15–35 mm. wide, gradually narrowed towards both ends, apex acute; middle cauline leaves lanceolate, 6–8 cm. long, 1–2.7 cm. wide, base rounded and broadly sessile, apex acute; inflorescence a pallid abundantly villose coarse terminal glomerate cluster, 4–10 cm. broad at anthesis and very dense, eventually 10–20 cm. broad, becoming less dense and revealing the crowded densely flowered forked individual cymes of which it is composed; bracts lanceolate, their acuminate tips slender and very prolonged; calyx abundantly and conspicuously white villose (hairs 1–5 mm. long), at anthesis 15–18 mm. long and borne on a pedicel 3–5 mm. long, at maturity about 20 mm. long and supported by a pedicel 8–12 mm. long; calyx-lobes linear, very slender, white villose; corolla (blue, fide Duthie) 13–17.5 mm. long, equaling the calyx-lobes or much surpassed by them, 6–7 mm. thick below the sinus, 3 mm. thick at base, outside villose above the middle, inside glabrous except on the nectary; corolla-lobes triangular, 2–3 mm. broad, 1–1.5 mm. long, weakly revolute, apex not sharply acute; anthers 6–7 mm. long, coherent at base only, attached 1.5–2 mm. above base, carried 6–7 mm. below the level of the corolla-sinus, sterile tip weakly developed, 0.5–0.8 mm. long, filaments 2–2.5 mm. long, attached 5.5–6.5 mm. above corolla-base, decurrent base swollen, fusiform, 3.5–4 mm. long, marked by fusiform depressions on the outside of corolla; nectary evident, a weakly lobed collar, densely villose on inner side; style 9–13 mm. long, glabrous; nutlets gray, angulate, coarsely rugose and tuberculate, 4–4.5 mm. long.

Himalaya of Garhwal and Kumaon (long. 79°–81° E.); reported from Kashmir.

INDIA: Chalck, Byans, 11–12000 ft., July 23, 1886, *Duthie 5824A* (DD); Palang Gadh,, Byans, 11–12000 ft., July 21, 1886, *Duthie 5824* (DD); Duktin, Darma Valley, Kumaon, Sept. 7, 1900, *Inayat 24757* (DD, K); Nipchang Valley, Darma, 14–15000 ft., Aug. 31, 1881, *Duthie 3193* (DD); Ralam Valley, Kumaon, Aug. 18, 1900, *Inayat 24755* (DD); Shafa udyar, Ralam Valley, Aug. 19, 1900, *Inayat 24756* (DD, UC); Ralam, 11000 ft., *Strachey & Winterbottom* (G); near Kauri Pass, Brit. Garhwal, 12–13000 ft., Sept. 8, 1886, *Duthie 4230* (DD); Jumnotri, Tehri-Garhwal, 1877, *Native Collector* (DD).

NEPAL: Nampa Gadh, 11–12000 ft., July 26, 1886, *Duthie 5824 bis* (DD).

A very distinct species and one lacking any obviously close relatives. Among its notable features are its broad, frequently somewhat triple-veined bicolored leaves, its very attenuate bracts, and its very slender villose linear calyx-lobes which equal or much surpass the corolla. The type of the species has not been seen. The original description, however, leaves no doubt as to its identity. It was originally given as collected at "Shree-nugur by Kamroop." Wallich also spelled the locality "Srinuggur."

Don in describing *O. macrocephala* from a duplicate of the same collection cited the collection-locality as "Sirinagur." All these location-names appear to refer to Srinagur in Kumaon, a locality about fifty miles easterly from Dehra Dun. The specimens probably came from the high mountains lying to the north or northeast of the locality.

23. **Onosma Hookeri** Clarke, Fl. Brit. India 4: 178 (1883). — Type from Sikkim, *Hooker*.

Perennial; indument hispid or hispid-villose and also minutely hispidulous or villulose, coarse hairs 2–5 mm. long, minute hairs less than 0.3 mm. long; stems several 1–4.5 mm. long, arising from a cluster of persisting leaves, unbranched, hispid or hispid-villose (hairs tending to be somewhat tawny), minute hairs usually scanty; leaves firm, thickish, margins revolute, midrib very prominent, upper surface usually with very scanty minute hairs, loosely appressed hispid or hispid-villose, the hairs usually with thickened bases, the lower surface usually pallid with a felt-like indument composed of very abundant minute hairs, coarse hairs usually very scattered and most abundant along the midrib, only rarely becoming abundant and clothing the surface; basal leaves oblanceolate, 5–15 (or rarely 20) cm. long, 5–15 mm. broad, usually acute; middle cauline leaves lanceolate or lance-linear, 3–12 cm. long, 3–15 mm. broad, base obtuse or rounded, apex acute; cymes usually terminal and solitary, rarely accompanied by a second smaller one produced from the uppermost leaf-axil, simple or forked, at anthesis 3–6 cm. broad, in fruit elongating but remaining densely flowered and becoming at most only 8 cm. long; bracts narrowly lanceolate or subulate, not conspicuous, appressed; calyx 12–22 mm. long, lobes subulate, hispid or hispid-villose or both, pallid or slightly tawny; pedicels 2–10 mm. long; corolla 16–28 (usually 19–26) mm. long, blue to purple or red, usually evidently bluish when dry, 5–12 mm. thick below the level of the sinus, 2–3 mm. thick at the very base, outside evidently appressed villose or villulose; anthers coherent at the very base, 5.5–8 mm. long, affixed 2 mm. above base, base held 5–9 mm. below the level of the sinus, sterile tip short ca. 0.5 mm. long; filaments linear, 3.5–6 mm. long, arising 9–19 mm. above base of corolla and hence slightly above the middle of the corolla, base conspicuously decurrent forming an elevated ridge 7–15 mm. long; nectary villose on the inner surface; style 22–30 mm. long, glabrous; nutlets ca. 3 mm. long, more or less rugose.

Known from Sikkim and Bhutan and adjoining Tibet.

SIKKIM: without locality, *Hooker no. 2* (G, ISOTYPE); Llonok, 15000 ft., Aug. 4, 1909, *Smith & Cave 2110* (DD).

BHUTAN: Philey La, Tibet border, long. 89°30′, 14000 ft., *R. E. Cooper 3464* (Ed); Lingshi Timpu, long. 89°30′, 13000 ft., *R. E. Cooper 1596, 1823*, and *1745* (Ed).

TIBET: Koo-ma-py-a, Chumbi, fl. bluish red, July 29, 1884, *King's Collector 617* (DD); Rudarg, Chumbi and Phari, fl. dark red, July 1879, *Dungboo* (DD); You-so near Chumbi, fl. purple, root used as dye, June 29, 1882, *Dungboo* (DD); Cho-leh-lay near Chumbi, fl. reddish blue,

July 3, 1878, *Dungboo* (DD); Linji La, 17000 ft., July 5, 1939, *Gould 2295* (DD); Tuna to Dochen, 14000 ft., Aug. 7, 1936, *F. S. Chapman 716* (DD).

23A. **Onosma Hookeri** var. **intermedium**, nom. nov.

Onosma Hookeri subsp. *Wardii* Stapf, Bot. Mag. **155:** t. 9254 (1931).—Type from Lake Pasum, Tsangpo Valley, eastern Tibet, *Ward*. Not *O. Hookeri* var. *Wardii* W. W. Smith (1916).

Corolla 24–28 mm. long, anthers 8–9 mm. long; filament 4–6 mm. long, borne at middle of corolla 12–14 mm. above its base; cymes becoming more loose at maturity, its bracts not secund but rather divaricate or reflexed.

Known only from eastern Tibet.

TIBET: Pasum Lake, long. 94°, rocky slope, 10–11000 ft., fl. violet, *Ward 6115* (Ed); Nyarlu, Gyamda Chu, long. 94°09′, 9800 ft., corolla purplish blue, pink at base, grass in open pine forest, *Ludlow, Sherriff & Taylor 6814* (G); Longong, long. 93°47′, grass-covered cliff-ledges, corolla rich dark blue, turns bluish pink later on; style crimson above middle, white below, *Ludlow, Sherriff & Taylor 5510* (G).

23B. **Onosma Hookeri** var. **longiflorum** Duthie ex Stapf, Bot. Mag. **155:** sub tab. 9254 (1931).

Onosma longiflorum Duthie, Kew Bull. **1912:** 40 (1912).—Type material from Gyantze, *Walton 57 & 1561;* Lhasa, ca. 3650 m., *Waddell.*

Corolla very elongate, 31–33 mm. long, bearing its filaments well above the middle; anthers 7–9 mm. long; filaments 4–7 mm. long, borne 18–20 mm. above base of corolla.

TIBET: Lhasa, open rocky slopes, 12000 ft., fl. reddish purple, *Ludlow & Sherriff 9572* (G); Hills north of Lhasa, 13500 ft., among boulders, fl. iridescent pinkish purple, *Ludlow & Sherriff 8687* (G); Nyenchengtang La, 4 days northwest of Lhasa, 13–14000 ft., cliff ledges, fl. dark red to dark blue, *Ludlow & Sherriff 9649* (G); Gyantze Hills, dry ground, July 13, 1907, *H. M. Stewart* (Ed).

A readily recognized species which has three geographic variants differing in length of corolla and in the position on the corolla at which the filaments arise.

24. **Onosma dichroanthum** Boiss. Diag. ser. 1, **11:** 107 (1849).—"Hab. in Iberia prope *Baku* (Meyer!) Persia boreali in monte *Demawend* prope *Ask,* Kotsch. no. 383."

Onosma setosum var. *dichroanthum* Boiss. Fl. Orient. **4:** 181 (1879); Lipsky, Acta Hort. Petrop. **26:** 499 (1910).

Plant biennial or a very short-lived perennial, conspicuously bristly and also very minutely hispidulous; coarse hairs abundant, grayish, spreading, 2–4 mm. long and (particularly on the upper leaf-surface) arising from a bulbose base; minute hairs abundant, commonly 0.1–0.2 mm. long; stems usually several, erect or ascending, branching above the middle, 3–7 mm. thick towards the base; basal leaves usually dried up at anthesis, clustered, 10–20 cm. long, 4–15 mm. broad, linear or linear-oblanceolate; middle

cauline leaves linear to oblance-linear, 4–15 mm. broad; bracts (especially the lowermost) distinctly lanceolate; cymes 5–6 cm. in diameter at anthesis, frequently forked, at maturity becoming a unilateral raceme 10–15 cm. long, borne terminal on the main stem and usually also on leafy branchlets produced from a few to many of the upper leaf axils; calyx 15–25 mm. long at anthesis, at maturity becoming 25–30 mm. long, pedicel at first about 5 mm. long, later becoming 10–15 mm. long, calyx-lobes linear or lance-linear; corolla yellow, 25–33 mm. long, base 2.5–3 mm. thick, gradually expanding upwards and becoming 10 mm. thick just below the level of the sinus, except for a tuft of hairs near the tip of the lobes, glabrous or practically so, lobes deltoid 2.5–4.5 mm. broad, recurving; anthers 9–12 mm. long, coherent at the base, attached 2.5–4 mm. above base, sterile tip 1–1.5 mm. long, base carried 8–12 mm. below level of corolla-sinus; connective swollen, muriculate; filaments linear, 3.5–4.5 mm. long, arising 17–20 mm. above corolla-base, usually evidently decurrent for about 10 mm.; nectary glabrous, collar-like or somewhat lobed, 0.3–0.8 mm. high; style glabrous, 25–33 mm. long; nutlets 4–5 mm. long, lustrous, pale, smooth or somewhat roughened.

INDIA: Waziristan, *A. M. Harriah* (DD); Chitral District, 1896, *H. Hamilton* (DD); Chitral District, 1894, *F. E. Younghusband* (DD); Chitral, 4900 ft., June 2, 1895, *Harriss* (DD); Guirat to Chitral, 4700 ft., May 31, 1895, *Harriss* (DD); Broz, 8500 ft., fl. yellow shaded to orange brown in age, June 6, 1895, *Harriss* (DD); Drosh, Chitral, 4500 ft., 1908, *Toppin 110* (K); Shinnak, Kurrum Valley, Apr. 1879, *Aitchison 28* (G, DD); Kurrum Valley, Para Chenar, Apr. 14, 1894, *Harriah* (DD); Kurrum Valley, June 3, 1879, *Harriah* (DD); Kaghusi, Gilgit Exped., 5500 ft., June 30, 1881, *Dr. Giles 375* (DD); Shinkiyari, Hazara, June 3, 1899, *Inayat* (DD).

AFGHANISTAN: Badghis, fl. yellow turning bright orange, May 23, 1885, *Aitchison 550* (DD, G).

BALUCHISTAN: Ziarat, 7000 ft., plant erect 1.5 ft. tall, fl. yellow, *H. Santapau 6449* (G); Kawas Pangi, 6000 ft., Apr. 30, 1893, *A. V. Munro* (DD).

U. S. S. R.: Ashkhabad district, *W. A. Dubiansky* in 1916 (G) and *Litwinow 1736* (G); Ashkhabad, in glareosis montium supra pagum Nephton, 1900, *Sintenis 212* (Missouri); Marghelan, Ferghana Dist., *Dessiatoff 489* (G); Turka, Atren Valley, Tashkent Dist., *Barodin 42* (G); Pishpek Dist., *Tsinserling & Sviachintzev 164* (G); Apsheron Peninsula (east of Baku) near Shuvelyany, marine sand, 1930, *Kariahin* (G).

Among all our species this is the only one which ranges far beyond our borders. Its nomenclature and its delimitation must be considered tentative until its representatives west and northwest of our area are given detailed study. The type of *O. dichroanthum* Boiss. and, also, of the apparently synonymous *O. caspicum* Gruner, Bull. Sov. Nat. Moscou 40[1]: 441, t. 9a (1867), came from the vicinity of Baku in Transcaucasia. I have seen only one collection from that general locality. It agrees reasonably well with the original descriptions of the species mentioned and furthermore is so similar to plants of our area that I am content to

treat them as conspecific under the name *O. dichroanthum*. This plant from the Apsheron Peninsula differs from the more easterly material in only one notable detail. Its anthers are free. They are not basally coherent as is universally the case among all other specimens of the species I have dissected.

Boissier, and also Lipsky, treated *O. dichroanthum* as a variety of *O. setosum* Ledeb. The latter was based on collections from near Astrakan and has its closest relations in middle and southern Europe among the immediate relatives of true *O. echioides* L., and particularly with *O. Visianii* Clem. of Roumania. It differs from our plant in having more elongate filaments borne at the middle of the shorter and stouter corolla. Furthermore, like *O. Visianii*, but unlike *O. dichroanthum*, the base of the calyx becomes slightly indurate as well as somewhat glabrescent at maturity.

25. **Onosma pyramidale** Hooker, Bot. Mag. 14: t. 6987 (1888). — Type grown at Kew from seeds sent by Duthie in 1885 and almost certainly gathered by him in the Kali Valley, Kumaon, in 1884.

Plant probably biennial; stems several, 2–6 dm. long, erect or ascending, 2–5 mm. thick towards the base, bearing floriferous branchlets (up to 10 cm. long) from the upper axils, younger parts hispid (hairs slender, spreading, cinereous, 1–2.5 mm. long); leaves numerous, usually drying dark, veinless, upper surface appressed hispid (hairs 1–2 mm. long), dotted with pallid hair-bases, lower surface paler and less hairy; basal leaves oblanceolate, 1–2 dm. long, usually drying up before anthesis; middle cauline leaves lanceolate, acute, 5–8 cm. long, 8–15 (–22) mm. broad; cymes relatively loose at anthesis, 2–3 mm. broad, simple or forked, terminal on the main stems and on the leafy branchlets from upper axils, at maturity becoming racemose, loose, up to 10 cm. long; bracts lanceolate, attenuate; calyx 8–11 mm. long, lobes lance-linear, 0.7–1.7 mm. broad, acute, hispid and hispidulous; pedicels very slender, 5–20 mm. long, spreading, hispid; corolla red ("bright scarlet fading to lilac"), 11–13 mm. long, barrel-shaped, broadest near the middle, 6–8 mm. thick, base 2 mm. broad, mouth 4–6 mm. broad; lobes 1.8–2 mm. broad, ca. 1 mm. long, recurved; corolla outside very minutely hairy (hairs both antrorse and retrorse), inside with a hairy nectary and villose on the filament-bases but otherwise glabrous; anthers 4–4.5 mm. long, joined at base only, base carried 4–4.5 mm. below level of corolla-sinus, affixed 0.5–0.7 mm. above base, sterile tip ca. 0.5 mm. long; filaments 5–6 mm. long, mostly subulate and glabrous but just above base thickened, geniculate and densely villose, arising 1.7–2.5 mm. above corolla-base, not distinctly decurrent; nectary very narrow, somewhat toothed, hairy; style 10–12 mm. long, glabrous, not exserted; nutlets 1.5–2 mm. long, dark colored, lustrous, obscurely rugose.

Indian Himalayas just west of Nepal border.

INDIA: Kali Valley, Byans, 9–10000 ft., rocks, fl. crimson, July 17, 1886, *Duthie 5827* (DD); Kali Valley, 8–9000 ft., fl. crimson, Sept. 16, 1884, *Duthie 3194* (DD, Ed); Budhi, Kali Valley, Sept. 14, 1900, *Inayat 24752* (DD, UC); Malpagarh, Kali Valley, Sept. 15, 1900, *Inayat 24753*

(DD); between Shirkha and Sosa, 9–10000 ft., fl. crimson, Sept. 19, 1884, *Duthie 3194* (DD); Sosa, Kali Valley, Sept. 17, 1900, *Inayat 24754* (DD); Palang Gadh, Byans, 9–10000 ft., July 19, 1886, *Duthie 5827* (DD); betw. Lamari and Budhi, Byans, fl. carmine, July 18, 1886, *J. R. Reid* (Ed).

This remarkable species is known only from Kumaon in the Himalayan valleys just west of the Nepal boundary. In the account of his explorations in 1884, Duthie, Gard. Chron. n. s. **25**: 456 (1886), mentions its discovery on Sept. 16 and notes it as an "Onosma sp., a handsome Boraginaceous plant with bright crimson flowers . . . , common on the rocks above Lamari." Its red barrel-shaped corollas quickly distinguish it from all other congeners. It has no close relatives. The corolla gradually swells from the base, becoming broadest near the middle and then gradually contracts towards the mouth. It has no inflexures below the sinus, nor does it have any puffed-out ribs nor any recesses on the outer surface in the vicinity of the filament-attachments. Although the barrel-shaped corolla suggests those of *O. bicolor* and its relatives, the resemblance is superficial. Furthermore, the filaments of *O. pyramidale*, geniculate and densely villose at the base, and also its divided calyx, are so different from those of *O. bicolor* and relatives that direct relation between our plant and the latter seems highly improbable.

26. **Onosma mertensioides**, sp. nov.

Planta 15–35 cm. alta; indumento adpresso haud denso; pilis adscendentibus 0.8–1.3 mm. longis gracilibus; caulibus basim versus ca. 3 mm. crassis erectis vel arcuate adscendentibus sub inflorescentiam non ramosis sparse foliatis pilis e basibus bulbosis orientibus obsitis; foliis costatis sed enervatis firmis, supra pilis e basi bulbosa orientibus donatis, subtus pallidioribus pilis gracilioribus donatis; foliis basalibus 5–8 mm. longis 7–10 mm. latis oblanceolatis; foliis caulinis medionalis oblongo-lanceolatis 5 cm. longis 8–10 mm. latis; cymis simplicibus 1–2 apice caulis approximatis, maturitate racemosis 10–12 mm. longis; bracteis lanceolatis basi abrupte rotundis; calyce sub anthesi 5–10 mm. longo, lobis linearibus 0.5–1 mm. latis; calyce maturitate 10–13 mm. longo, lobis lanceolatis 1–1.5 mm. latis hispidulis; pedicellis ad anthesi 3–5 mm. longis mox 10–14 mm. longis; corolla (in sicco caerulescenti) 16–17 mm. longa calyce duplo longiore a basi 2.5–3 mm. crassa sursum gradatim ampliata apicem versus 7–9 mm. crassa extus dense antrorseque pubescenti intus sub lobos sparse inconspicueque strigulosa; lobis corollae 3–3.5 mm. longis 1.5–2 mm. latis recurvis; antheris 7–7.5 mm. longis basi cohaerentibus 1.5–2 mm. supra basim affixis, basibus 6.5–8 mm. sub sinus corollae positis, apicibus sterilibus ca. 1 mm. longis; filamentis subulatis 4–5 mm. longis 5–6 mm. supra basim corollae affixis, basibus decurrentibus 3 mm. longis crassiusculis parte inferiore tumidis; nectario angustissimo ad 0.2 mm. alto lobulato villoso; stylo glabro ca. 19 mm. longo; nuculis ignotis.

CHINA (Sikang): between Baurong and Tachienlu, via Hadjaha, May-June, 1929, *Herbert Stevens 483* (TYPE, Gray Herb.).

A very well marked species for which I can suggest no very close relatives.

27. **Onosma limitaneum,** sp. nov.

Planta hispidissima; pilis majoribus conspicuis abundantibus 2–4 mm. longis saepe e basibus bulbosis orientibus; pilis minoribus erectis ad 0.1 mm. longis inconspicuis; caulibus solitariis vel pluribus e radice palari 3–7 mm. crasso purpureo-tincto ut videtur perenni erumpentibus erectis vel adscendentibus simplicibus vel supra medium ramulis fertilibus gestis basim versus 2–5 mm. crassis; foliis firmis crassiusculis enervatis facie superiore pilis rigidis e basi bulbosa erumpentibus dense armatis; foliis basalibus oblanceolatis 2–6 cm. longis 5–10 mm. latis sub anthesi plus minusve persistentibus; foliis caulinis oblongis vel lanceolatis; cymis ad anthesin densis 2–2.5 mm. crassis mox 4–7 mm. longis densifloris, bracteis lanceolatis acutis inconspicuis; calyce sub anthesi 8–10 mm. longo 1–2 mm. longe pedicellato, maturitate 10–12 mm. longo 3–5 mm. longe pedicellato, lobis linearibus extus hispidis intus conspicue abundanterque villosis; corolla (8–)10–12 mm. longa angusta subcylindracea, basi 2 mm. crassa, apicem versus 3–5 mm. crassa, extus supra medium vel solum lobis puberulenta, lobis deltoideis 1.5 mm. latis recurvatis; antheris 4–5 mm. longis basi cohaerentibus saepe 1.5(1.3–2) mm. supra basim affixis, basibus 4–5 mm. sub sinus corollae positis, apicibus sterilibus 0.5–0.9 mm. longis; filamentis (2–)2.5 mm. longis, (3.5–)4 mm. supra basim corollae affixis, basi 0.3–0.8 mm. latis transverse arcuateque affixis sursum gradatim attenuatis deorsum vix decurrentibus; nectario 0.1–0.5 mm. alto sparse villuloso vel subglabro; stylo 9–12 mm. longo glabro; nuculis 3–4 mm. longis laevibus nitidis.

BALUCHISTAN: Sin Kachh, May 12, 1897,—no. *20600* (DD); Kharwande, June 7, 1897,—no. *20600B* (DD); Gastoi, May 28, 1897,—no. *20600A* (DD); Mina Bazaar, alt. 4800 ft., May 11, 1896,—no. *18928* (DD); Fort Sandemann, 4600 ft., May 16, 1896,—no. *18927* (TYPE, Dehra Dun); Gival, 5–6000 ft., May 6, 1893, *A. V. Monro* (DD); Gival, 6000 ft., Apr. 27, 1888, *J. H. Lace 3794* (DD).

INDIA (Northwest Frontier): Waziristan, *native collector 15804A* (DD); Shinnak to Kuram, Kurrum Valley, Apr. 1879, *Aitchison* (DD).

27A. **Onosma limitaneum** var. **parviflorum,** var. nov.

A varietate genuina differt floribus minoribus; corolla 7–9 mm. longa extus puberulenta basi 1.5–2 mm. crassa sinus versus 2–3 mm. crassa, lobis triangularibus 0.8–1.2 mm. longis; antheris 2.5–3 mm. longis 0.5–0.7 supra basim affixis; filamentis 1.5–2 mm. longis 3 mm. supra basim corollae affixis; stylo 5.5–6.5 mm. longis.

AFGHANISTAN: without locality, *Griffith 5949* (TYPE, Gray Herb.; ISOTYPE, DD).

PERSIA: without locality [? Ispahan], *Derderian* (G).

27B. **Onosma limitaneum** var. **majus,** var. nov.

A varietate genuina differt floribus robustioribus; corolla 15–17 mm. longa extus (costa loborum sparse hispidulosa excepta) glabra, basi 2–2.5 mm. crassa, sinus versus 5–6 mm. crassa, lobis triangularibus 1.5 mm.

longis; antheris 5.5–6.5 mm. longis, 1.5–2 mm. supra basim affixis; filamentis 3.5–4 mm. longis, 6–8 mm. supra basim corollae affixis.

AFGHANISTAN: without locality, *Griffith 5946* (TYPE, Gray Herb.).
BALUCHISTAN: without locality, *Stocks 997* (DD).

Closely related to *O. stenosiphon* Boiss. and formerly confused with it. Readily separated from Boissier's species by having the filaments borne not at the middle of the corolla but rather distinctly below it. *Onosma stenosiphon* was based on plants from north-central Persia. Its type collection has corollas 14.5–15 mm. long which are minutely hispidulous outside. The anthers are 5 mm. long and attached 1.7 mm. above the base. The filaments are 1.7–2 mm. long and arise 7–7.5 mm. above the corolla-base. As compared with those of *O. limitaneum* the filaments of *O. stenosiphon* are not only attached higher in the corolla but are also proportionately only half as long. The base of the anther is held about opposite the filament-attachment, not opposite the middle of the filament as in *O. limitaneum*.

28. **Onosma cingulatum** W. W. Smith, Notes R. Bot. Gard. Edinburgh 9: 112 (1916). — Type from plateau near Chaotung, northeastern Yunnan, *Maire 296*.

Plant 7–15 dm. tall, very bristly with abundant stiff tawny hairs 1–3 mm. long, also abundantly though inconspicuously villulose; stems erect, simple below, 4–10 mm. thick, above the middle producing numerous floriferous branches 1–2 dm. long; basal leaves and lower cauline leaves unknown; middle cauline leaves lanceolate, 4–8 cm. long, 1–2 cm. broad, occasionally showing a few obscure veins, base sessile and rounded to acute, apex acute; cymes produced abundantly, paniculately displayed, at anthesis 2–3 cm. broad, at maturity lengthening and loose becoming racemose and 4–6 cm. long; calyx 7–9 mm. long at anthesis, 12–15 mm. long in fruit, lobes narrow; pedicels very slender, 5–15 mm. long; bracts lanceolate; corolla pink, 9.5–10.5 mm. long, gradually expanding from the base upwards, 5.5–8 mm. broad, appressed hairy outside, inside glabrous except for the villose nectary; anthers 4–4.5 mm. long, coherent at the base, affixed 1 mm. above base, base carried 5–6 mm. below the level of the corolla-sinus, sterile apex ca. 0.7 mm. long; filaments 2–2.5 mm. long, subulate, arising 2–2.5 mm. above corolla-base, with thickened decurrent base ca. 1 mm. long; nectary very narrow, somewhat lobed, 0.5 mm. high or less, villose; style glabrous, 7–9 mm. long, not exserted; nutlets 2.5 mm. long, lustrous, dusky, obscurely punctate and verrucose.

Known only from northeastern Yunnan.

YUNNAN: "pâtures des plateaux à Tcha-ho," 2800 m. alt., 1914, *Maire 296* (TYPE, Ed); without locality, plant 19 dm. tall, *Maire 892* (Ed, G).

The basal structures of this very well marked species are unknown. Very likely, however, the plant is a biennial with a single stiff erect stem producing numerous floriferous branchlets above its middle.

29. **Onosma Tsiangii,** sp. nov.

Planta ut videtur erecta biennis saltem 1 mm. alta; caule medium versus 6–7 mm. crasso cinereo ramulos floriferos graciles adscendentes 7–12 cm. longos proferente pilis erectis sparsis 1–1.5 mm. longis basi bulbosa erumpentibus et pilulis abundantibus retrorse-adscendentibus praedito; foliis caulinis medionalibus lanceolatis 5–9 mm. longis 15–20 mm. latis firmis cinereis basi late sessilibus rotundis, apice acutis, facie superiore pilis abundantibus adpressis 1–2 mm. longis e basi pallida discoidea erumpentibus et pilulis 0.1–0.2 mm. longis sparsissimis donatis, facie inferiore subvelutinis pilulis 0.1–0.2 mm. longis erectis abundantissimis et pilis robustioribus sparsis obsitis evidenter nervatis; cymis eis ejusdem ramuli solum cognitis 1–3 cm. latis simplicibus vel furcatis; bracteis 3–6 mm. longis lanceolatis inconspicuis; calyce 9 mm. longo, lobis ca. 1 mm. latis lanceo-subulatis; pedicello gracili 7–11 mm. longo; corolla purpurea (in sicco brunnescenti) 11 mm. longa a basi 2 mm. crassa sursum gradatim ampliata apicem versus 7 mm. crassa, extus supra medium dense antrorseque pallido-strigulosa; antheris 5.5 mm. longis, basi cohaerentibus ca. 1.5 mm. supra basim affixis, basibus 4–5 mm. infra sinus corollae positis, apicibus sterilibus ca. 0.5 mm. longis; filamentis 4 mm. longis a basi 0.5 mm. latis sursum attenuatis ca. 3.5 mm. supra basim corollae affixis, basibus decurrentibus ca. 1 mm. longis tumidis pilulis adpressis sparse donatis; nectario 0.5–1 mm. alto intus dense villoso; stylo 11–12 mm. longo infra medium pilulis adpressis sparsis donatis; nuculis ignotis.

CHINA (Yunnan): Tai-hwa-shan, Kunming, along shady trail, 2000–2300 m. alt., fl. deep purple, July 20, 1933, *Y. Tsiang 11201* (TYPE, Gray Herb.).

Of this well-marked species I have seen only a section of the midstem which bears middle cauline leaves and numerous leafy axillary branchlets terminated in cymes. The plant probably has a habit similar to that of *O. cingulatum*.

30. **Onosma verruculosum,** sp. nov.

Planta gracilis; radice et base caulis ignotis; caulibus ut videtur ca. 5 dm. longis gracilibus 2–3 mm. crassis supra medium ramulis adscendentibus 10–15 cm. longis donatis, indumento sparso donatis, hispidis et hispidulis; pilis majoribus sparsis rigidulis patentibus 2–3 mm. longis e basi bulbosa orientibus; pilulis abundantioribus rigidulis contortis vel retrorse adpressis 0.1–0.4 mm. longis; foliis adpresse hispidis et antrorse minuteque strigulosis (pilis majoribus rigidis 1–2 mm. longis e basi discoidea orientibus; pilulis valde adpressis ca. 1 mm. longis), facie superiore viridis, facie inferiore obscure venosis pallidioribus; foliis inferioribus oblanceolatis ad 8 cm. longis; foliis superioribus lanceolatis 5–7 cm. longis 7–9 mm. latis apice acutis basi acutis obtusisve; cymis sub anthesi 1.5–2 cm. latis simplicibus vel furcatis, maturitate elongatis secundis racemosis ca. 6 cm. longis; calyce 6–7 mm. longo, tubo cupuliformi, lobis cuneatis 3.5–4 mm. longis basi 1.5–2 mm. latis acutis costatis hispidis;

pedicello 2–8 mm. longo; corolla coerulea 14–15 mm. longa utroque contracta basi 1.5 mm. crassa, apice 2–3 mm. crassa, parte medionali ⅔ subcylindracea sursum leviter ampliata ad 10 mm. supra basim 5–7.5 mm. crassa, extus sparse minuteque retrorse-strigulosa supra medium sub lente evidenter verruculosa, a fundis sinuum usque ad medium tubi 5-sulcata, infra medium costis 5 inflatis et areolis 5 planis ellipticis 4 mm. longis (apice haud invaginatis) ornata; lobis minutis recurvis ca. 1 mm. latis; antheris 4.5 mm. longis basi cohaerentibus ca. 1 mm. supra basim affixis inclusis, basibus ca. 4.5 mm. sub sinus corollae positis, apicibus sterilibus 0.7 mm. longis; filamentis 4.5–5 mm. longis subulatis 4–4.5 mm. supra basim corollae affixis basi 1–2 mm. latis, duobus symmetricis medionervatis transverse arcuateque affixis, ceteris asymmetricis (nerviis excentricis donatis), duobus oblique et uno verticaliter affixis et plus minusve decurrentibus, omnibus villulosis; nectario 1–1.3 mm. alto sparse villuloso; stylo ca. 15 mm. longo glabro; nuculis 2.5 mm. longis brunneis tuberculatis et minute abundanterque papillatis.

NEPAL: Tatey, 9000 ft., fl. blue, 1930, *Lall Dhwog 161* (TYPE, Edinburgh).

A well-marked species having general relations not only with *O. bicolor* but also with *O. lycopsioides* and its allies. From *O. bicolor* and related species of the middle Himalayas it is distinguished by its relatively large corollas. The narrow, less firm leaves, smaller calyx, and the proportionately more elongate, more protrudent, verruculose corollas of thinner texture all distinguish *O. verruculosum* from *O. lycopsioides* and its close relatives. The type of our species lacks the basal parts of the plant. If we may judge from its slender stems, the root is probably a weak one, perhaps similar to that of *O. bicolor*.

31. **Onosma Borii** Fischer, Kew Bull. 1940: 38 (1940). — Type from Laruri, Naga Hills, Assam, *Bor 39*.

Root probably perennial; stems probably several (basal half unknown), at least 3 dm. long, pale, ca. 2.5 mm. thick, bearing not only scattered rigid spreading hairs 1–2 mm. long arising from bulbose bases, but also smaller appressed or incurving hairs 0.1–0.5 mm. long; basal leaves not seen; upper cauline leaves lanceolate, 4–5.5 cm. long, 8–12 mm. broad, broadest at or below the middle, obscurely veined, apex acute, base abruptly contracted, obtuse and sessile, surface scabridulous, with short appressed hairs, 0.6–1.2 mm. long, from discoid bases, and also strigulose with hairs about 0.1 mm. long, lower surface paler, abundantly and minutely strigulose and also scantily strigose with hairs 0.5–1 mm. long, bearing some coarse spreading hairs on the prominent midrib and revolute leaf-margins; cymes terminal on stems and on branchlets from the uppermost axils, simple or forked, at anthesis ca. 2 cm. diameter, in age racemose and as much as 5 cm. long; calyx 8–10 mm. long, hispid, tube cupulate, calyx-lobes cuneate or narrowly triangular, apex somewhat attenuate, 5–6(–7) mm. long, 2–3 mm. broad at base; pedicels 2–10 mm. long; corolla blue changing

to pink at mouth, barrel-shaped, 14–15 mm. long, broadest (8 mm.) about 1 cm. above base, mouth 3–4 mm. diameter, outside very minutely and retrorsely strigulose, inside with scanty hairs about base of filaments, sulcate below the sinus, below middle with puffed-out ribs protruding between the calyx-lobes and also with alternating elliptic depressions 5 mm. long (depressions with very small invagination at upper end); anthers 5–5.5 mm. long, coherent at base, affixed 1 mm. above base, not exserted, sterile tips 1.5 mm. long denticulate; filaments 3–4 mm. long, strap-shaped with expanding base, with evident mid-vein, arising ca. 5 mm. above corolla base; two filaments with symmetric base, medial vein and transverse arcuate attachment, the other with oblique or vertical attachment, and asymmetric more or less decurrent base and excentric vein; nectary a glabrous collar about 1 mm. tall; style glabrous to 16 mm. long; nutlets 2.5 mm. long, dark, dull, plump, irregularly tuberculate and also abundantly and minutely papillate.

INDIA: Laruri and Shiloi Jopi, Naga hills, Assam, 4000–8000 ft., basal rosette of leaves lying procumbent, fl. blue changing to pink at mouth, Nov. 17, 1935, *N. L. Bor 39* (K, TYPE).

Closely related to *O. lycopsioides*, from which it differs chiefly in the nature of its indument. It is a plant with smaller leaves and pale stems. Unlike its relative it is not evidently bristly. Because of the short appressed hairs on stems and leaves it is relatively smooth in appearance. The differences between the species are not impressive and possibly may not prove to be of specific value.

32. **Onosma lycopsioides** Fischer, Kew Bull. 1940: 39 (1940). — Type from Japvo, Naga Hills, Assam, *Bor 6501*.

Plant perennial from a strong root; stems several, erect, 3–5 dm. tall, simple or with ascending floriferous branchlets 1–1.5 cm. long, 3.5–5 mm. thick towards base, villose-hispid with the slender spreading hairs 1.5–3 mm. long; leaves obscurely to evidently veined, villose-hispid (larger hairs not very abundant, 1.5–3 mm. long, arising from discoid or bulbose bases; minute hairs 0.1–0.2 mm. long, appressed, scanty or none), upper surface darkened in drying, lower surface becoming grayish; basal leaves oblanceolate, 10–18 cm. long, 8–15 mm. broad above the middle, apex acute; middle and upper leaves lanceolate to ovate-lanceolate, 5–10 cm. long, 1–3.5 cm. broad, base obtuse, apex acute; cymes terminal, frequently forked, 2–3 cm. broad at anthesis, in age becoming loosely racemose and 4–6 cm. long; calyx 7–9 mm. long, tube broadly cupulate, lobes narrowly triangular, 4–5 mm. long, 1.5–3 mm. broad at base, hispid; pedicels 1–10 mm. long; corolla blue to purplish blue, 16–18 mm. long, barrel-shaped, broadest ca. 10 mm. above base where 7–9 mm. thick, mouth 3–4 mm. diameter, inner surface somewhat hairy on and near attachment of stamens, outer surface minutely and retrorsely pubescent, sulcate below the sinus, below the middle with puffed-out ribs alternating with large plane elliptic areas (areas not invaginate at upper end); corolla-lobes

minute, recurved; anthers 5.5–6 mm. long, coherent at base, affixed 1 mm. above base, sterile tip denticulate 1 mm. long, not exserted from corolla; filaments 4–5.5 mm. long, subulate with a broadened base, affixed 5–6 mm. above corolla-base; two filaments symmetric, with medial nerve, transversely and arcuately attached, the other three filaments with asymmetric base excentric nerve and oblique or vertical attachment and base more or less decurrent; nectary a collar ca. 1 mm. high, somewhat villose towards base on inner surface; style 17–19 mm. long, glabrous; nutlets ovoid, 2.5–3 mm. long, dull coarsely tuberculate as well as abundantly and minutely papillate.

INDIA: Japvo, Naga Hills, Assam, 9900 ft., fl. bluish purple, Sept. 27, 1935, *N. L. Bor 6507* (Kew, TYPE).

CHINA (western Yunnan): Shweli-Salwin divide, lat. 25°40′, open stony alpine pasture, 11000 ft., 12–20 in. tall, fl. purplish rose, July 1924, *Forrest 24663* (G, Ed); Shweli-Salwin divide, lat. 25°30′, open stony pasture on margin of thicket, 10000 ft., 12–18 in. tall, fl. bright blue, Aug. 1918, *Forrest 17568* (Ed).

The type of *O. lycopsioides* is a specimen showing the upper two thirds of a plant in the early fruiting state. The single corolla associated with it was dissected by the author of the species and can be examined only in its opened dried state. As far as can be determined from comparisons, the type seems essentially similar to collections made by Forrest near the China-Burma frontier about 500 km. to the eastward of the type locality of the species. The differences detected fall within the range of variation to be expected within a species of this genus. They can be worthy of nomenclatoral recognition only if they prove to be geographically correlated. The type collection has slightly broader upper cauline leaves than the collections from China and the coarser hairs have discoid rather than bulbose bases. Its stamens have longer (5–6 rather than 4–5 mm. long) filaments which are also abundantly rather than sparingly hairy at the base.

The species is obviously related to *O. microstoma* of southwestern China and, especially so, to *O. Borii* of Assam. The Chinese species is distinguished by its smaller leaves, abruptly rounded at the base, and also by its much denser indument. *Onosma Borii* also has smaller leaves, but these dry pale rather than dark as in *O. lycopsioides* and *O. microstoma,* and, since their hairs are short and very appressed, they are smoother and very much more tidy in appearance. *Onosma lycopsioides* and its close relatives evidently belong to the same immediate circle of relationships as *O. emodi,* and agree with that species not only in their distinctive calyx but also in many details of their elaborately organized corollas. Their corollas similarly have a small mouth and above their middle, because of narrow inflexed plaits, are also sulcate below each sinus. Below the middle their puffed-out ribs, protruding between the calyx-lobes, and the elliptic depressions, hidden behind the calyx-lobes, are similar also though much less well developed. In *O. emodi,* however, there is a saccate invagination at the upper end of the depressions on the corolla. This invagination

inside the corolla forms a protuberance from which the stamens arise. Such invaginations are lacking in *O. lycopsioides* and its close relatives. In these species the stamens arise directly from the corolla-wall. Surprisingly, the five filaments in each corolla differ among themselves in form and attachment. Two have an arcuate attachment oriented transversely and have a medial nerve and a symmetric non-decurrent base. Two others are obliquely affixed and have an excentric nerve and an asymmetric decurrent base. The fifth stamen is vertically affixed and has an excentric vein and a more prolonged asymmetric decurrent base. Though the corolla itself is regular, its stamens, in their differing types of base and attachment, show a trend towards bilateral symmetry. This condition has been observed in *O. verruculosum*, *O. Borii*, *O. lycopsioides*, *O. microstoma*, and *O. egregium*. It may also be present in *O. bicolor*.

33. **Onosma microstoma,** sp. nov.

Planta perennis e radice valida palari ad 1 cm. crassa oriens; caulibus pluribus 3–6 dm. longis simplicibus ca. 3 mm. crassis villoso-hispidis, pilis gracilibus patentibus 3–4 mm. longis abundante donatis; foliis basalibus et caulinis inferioribus tempore florendi emarcidis, medionalis et superioribus lanceolatis in sicco fuscis 4–6 cm. longis 10–13 mm. latis medium versus vel infra medium latioribus, apice acutis, basi abrupte rotundis sessilibus, facie superiore abundante adpresseque villoso-hispidis (pilis 2–3 mm. longis), facie inferiore griseis villoso-hispidis et strigulosis bases pallidas pilorum deficientibus; cymis terminalibus densis sub anthesi 3 cm. latis; calyce 7–10 mm. longo, tubo cupuliformi 2–3 mm. profundo, lobis anguste triangularibus apice plus minusve attenuatis 5–6 mm. longis basi 1–3 mm. latis villoso-hispidis; pedicello 2–10 mm. longo; corolla purpureo-coerulea 16 mm. longa oblongo-obovoidea utroque contracta a basi 1.5–2 mm. crassa sursum gradatim ampliata ca. 10 mm. supra basim crassissima (8–9 mm. lata) deinde abrupte contracta apice ore 2.5–4.5 mm. diametro donata, intus basim filamentorum versus sparse villosula extus dense retrorseque pubescenti, a fundis sinuum usque ad medium tubi 5-sulcata, infra medium tubi costis 5 inflatis et areolis 5 planis ellipticis ca. 4 mm. longis (apice haud invaginatis) ornata; antheris 5.5 mm. longis inclusis basi cohaerentibus 1 mm. supra basim affixis, apicibus sterilibus ad 1 mm. longis denticulatis, basibus ca. 6 mm. infra sinus corollae positis; filamentis 5–6 mm. longis subulatis a basi lata villulosa sursum gradatim attenuatis, 6–6.5 mm. supra basim corollae affixis, duobus symmetricis medionervatis transverse arcuateque affixis, ceteris asymmetricis nerviis excentricis donatis plus minusve decurrentibus duobus oblique et uno verticaliter affixis; nectario 1–1.5 mm. alto intus villoso; stylo 18 mm. longo glabro; nuculis ignotis.

CHINA: Chenkang, Snow Range, Hsiaoshushan, southwestern Yunnan, open rock slopes, 3000 m. alt., common perennial 1–2 ft. tall, fl. purplish blue, Aug. 5, 1938, *T. T. Yü 17227* (TYPE, Gray Herb.).

A close relative of *O. lycopsioides*, distinguished by its very much more

abundant villose-hispid indument and its smaller stem-leaves abruptly rounded at the base.

34. **Onosma dumetorum,** sp. nov.

Planta cinerea 3–6 dm. alta; caulibus ad 7 dm. longis basim versus 4–5 mm. crassis hispidis (pilis gracilibus patentibus 2–3 mm. longis e basi bulbosa orientibus) basim versus ramosis, ramulis adscendentibus ad 3 dm. longis; foliis (radicalibus ignotis tempore florendi nullis) caulinis numerosis, facie superiore viridibus adpresse hispidis (pilis 1–2 mm. longis e basi discoidea pallida orientibus) et minute strigulosis, in facie inferiore pallidis adpresse hispidis et abundantissime strigulosis; foliis inferioribus plus minusve oblanceolatis 6–10 cm. longis 1.5–2 cm. latis apice acutis supra medium latioribus deinde deorsum basim versus gradatim attenuatis, foliis medialis et superioribus lanceolatis utroque acutis 4–8 cm. longis 1–2 cm. latis medium versus latioribus; cymis terminalibus furcatis sub anthesi ca. 2 cm. latis; calyce 5–7 mm. longo, tubo cupuliformi 1–2 mm. profundo, lobis anguste triangularibus 4–5 mm. longis basi 1.5–2 mm. latis extus villoso-hispidis, intus pilis albis adpressis dense vestitis; pedicello 2–10 mm. longo; corolla lutea 12 mm. longa utroque contracta medium versus crassissima (4–5 mm. crassa) basi 2 mm. crassa, ore 3–4 mm. diametro, extus minute retrorseque strigulosa, a fundis sinuum usque ad medium tubi 5-sulcata, infra medium tubi costis 5 inflatis et areolis 5 planis ellipticis apice haud invaginatis ornata, intus basim versus filamentorum villulosa; lobis obtusiusculis 1–1.5 mm. longis latisque; antheris 4 mm. longis basi cohaerentibus inclusis, 1 mm. supra basim affixis, apicibus sterilibus ca. 1 mm. longis, basibus ca. 5 mm. infra sinus corollae positis; filamentis 5 mm. longis subulatis 2–3 mm. supra basim corollae affixis, duobus symmetricis medionervatis transverse arcuateque affixis, ceteris asymmetricis nervio excentrico donatis duobus oblique et uno verticaliter affixis et plus minusve decurrentibus; nectario 1 mm. alto villoso; stylo 10–12 mm. longo glabro; nuculis tuberculatis et minute papillatis opacis.

CHINA: Shunning, Wumulung, southwestern Yunnan, 2450 m. alt., common herb 1–2 ft. tall, at margin of thicket, fl. yellow, July 9, 1938, *T. T. Yü 16629* (TYPE, Gray Herb.).

A very well marked species perhaps most closely related to *O. lycopsioides,* from which it is quickly distinguished by its small, proportionately more elongate corollas, yellow rather than blue or bluish purple in color.

35. **Onosma emodi** Wall. in Roxb. Fl. Indica, ed. Carey, **2:** 11 (1824); G. Don, Gen. Syst. **4:** 316 (1838); Clarke, Fl. Brit. India 4: 179 (1883). — Type from "Gosain-Than in Nepal," probably *Wallich 937.*

Maharanga emodi (Wall.) DC. Prodr. **10:** 71 (1846).

Onosma vestitum Wall. Numerical List, p. 26, sub no. 937 (1829), nomen; G. Don, Gen. Syst. **4:** 317 (1838). — Type from Gosain-Than, Nepal, *Wallich 937.*

Plant perennial from a strong taproot; stems usually several, leafy, decumbent or ascending, 2–5 dm. long, 4–5 mm. thick towards base, simple or producing loose floriferous branches above the middle, usually hirsute especially above middle; leaves on upper surface hispid and minutely strigulose, the hair-bases not conspicuous, on lower surface paler, hairs similar to those on upper surface but usually more scanty, cauline leaves acute, lanceolate or oblanceolate, elongate, mostly broadest at or above middle, 5–15 cm. long, 7–20 mm. broad, frequently with some veins; basal leaves oblanceolate, petiolate; cymes terminal, usually forked, grouped to form a rounded terminal cluster usually 4–5 cm. broad at anthesis; calyx 6–10 mm. long, with short broad tube, lobes triangular or lance-triangular, acute, 3–6 mm. long, 2–3 mm. broad at base; pedicels slender, 3–10 mm. long; corolla 9–13 mm. long, from a short tubular base 2–2.5 mm. thick and ca. 2 mm. long abruptly expanding and becoming 7–10 mm. thick slightly below middle and then gradually contracting (to a point in the bud) to a mouth no more than 5 mm. in diameter, outside hispidulous or villulose (hairs 0.2–0.5 mm. long, not very abundant, tending to be retrorse), above the middle longitudinally plaited and hence more or less grooved below each lobe-sinus (plaits inflexed, by tightness of fold controlling apparent diameter of corolla-mouth and apparent breadth of lobes, also the degree to which corolla as a whole contracts in diameter above middle); below middle of corolla outside each plait replaced by a large sharply defined elliptic depression (hidden by calyx-lobe) with a deep pocket at upper end (this pocket inside corolla forms the shoulder of one of the 5 stamen-bearing protuberances); because of the inflexure and depression below each lobe-sinus the intervening sectors of the corolla (those below the lobes) appear puffed out to form coarse convex longitudinal ribs especially prominent on the lower middle quarter of the corolla where they help give the latter its maximum diameter; swollen ribs just below their most prominent portion ended by an abrupt contraction, their most prominent part bulging out between the calyx-lobes with their abruptly contracted lower end, chin-like, resting on the bottom of the adjacent calyx-sinus; corolla-lobes small, recurved, 1.5–2 mm. broad and 1–1.5 mm. long; corolla inside below the middle bearing 5 thickish somewhat wedged-shaped protuberances which project into the corolla-cavity 1–2 mm. or more, converge about the style, and bear the filaments on their upper inner extremity; protuberances somewhat hairy, containing a pocket-like invagination originating on the outside of the corolla, base 2–3 mm. long, narrowing and only 1–2 mm. long on the vertical distal margin, uppermost edge nearly horizontal; anthers 4–5.5 (usually 4.5) mm. long, coherent at base only, included, affixed about 1 mm. above base, sterile apex 0.5–1 mm. long serrulate; filaments 1–2 (usually 1.5) mm. long, glabrous, borne 3.5–6 (usually 4–5) mm. above corolla-base on the shoulder of a protuberance, flat, subulate-linear with evident midnerve, usually bent into a sigmoid curve, below attachment decurrent to form a pair of narrow wings (1–2 mm. long and 0.1–0.5 mm. high) along the

crest of the protuberance; nectary a conspicuous collar, 1–1.5 mm. high, usually somewhat hairy; style glabrous, 10–12 mm. long; nutlets 2–3 mm. long, dull, coarsely tuberculate and also very abundantly and minutely papillate.

Eastern Himalayas, Garhwal to western Bhutan, long. 80° to 90°.

GARHWAL: Tungnath, 12000 ft., *Strachey & Winterbottom* (G); near Kuari Pass, 11–12000 ft., fl. pink, Sept. 10, 1885, *Duthie 4231* (DD).

NEPAL: Gossain Than, *Wallich 937* (Ed, ISOTYPE *O. vestitum*); Tak Tor, 12–13000 ft., fl. orange, 1930, *Lall Dhwoj 49* (Ed); without locality, 1927, *Clive Wigram 30* (Ed); without locality, *Lall Dhwoj 119* and *130* (Ed).

SIKKIM: Chola Range to Gnatong, 12000 ft., Sept. 30, 1892, *G. A. Gammie 1326* (DD); Gnatung, Aug. 1891, *Cummins* (DD); Kyang lashe, 9000 ft., July 22, 1945, *Bor's collector 727* (DD); Sandokphoo, Aug. 1887, *King's collector* (DD); Too-koo-la, July 14, 1877, *G. King 4313* (DD); Pa-tang-la, Sept. 1, 1882, fl. pink, *King's collector* (DD); Ko-pish, Aug. 25, 1878, fl. red, *Dungboo* (DD); Phallut, 11000 ft., 1913, *Ribu & Rhamoo 6331* (Ed); Megu, 14000 ft., fl. yellow, July 7, 1913, *R. Lepcha 818* (Ed); Gongri, 13000 ft., Oct. 1938, *B. N. Ghose* (G).

BHUTAŃ: La-ree, fl. reddish blue, June 30, 1884, *Dungboo 350* (DD); Tang Chen, Ritang, 12500 ft., on cliff-ledges and steep open slopes among stones, fl. blue-violet to purplish blue, lobes bright red or reddish black, calyx almost black, June 9, 1937, *Ludlow & Sherriff 3234* (G).

The corolla of *O. emodi* is the most elaborate in the genus. It is obese in form and has puffed-out longitudinal ribs which below the middle alternate with sunken areas. Below the middle inside it has five prominent intrusions from which the stamens arise. The result is a corolla very different from the form prevailing in the genus. All its peculiarities, however, both individually and collectively, are simply extreme manifestations of tendencies more or less developed by related species. A study of these latter reveals a very complete series of forms transitional between the extreme corolla of *O. emodi* and the much less complex one conventional in the genus. The genus *Maharanga,* based on the complex floral structures of *O. emodi, O. Wallichianum,* and *O. bicolor,* accordingly is untenable.

Only an artist working from fresh flowers can properly portray the corolla of *O. emodi.* Words are very inadequate for the purpose. The description given above, the most complete yet attempted, needs to be verified and augmented by someone with fresh flowers available. Some of my corrections of previous descriptions need noting. The suprabasal collar-like nectary of *O. emodi* differs from that of other species only in being especially well developed. Wallich and DeCandolle, however, were much impressed by it. The former described it as the base of the corolla bent inward and embracing the ovary. DeCandolle, though identifying it as only a coroniform appendage, failed to recognize it as the structure present on the corollas of most *Onosma* species and accordingly as one not particularly significant. One of the most unusual features of the corolla of *O. emodi* is the well-developed wedge-shaped protuberances from which

the stamens arise. These project into the corolla-cavity, nearly filling it, just below its middle. They are saccate invaginations (opening on the outside of the corolla) given greater prominence by the decurrent filament-base that provides each with knife-like crests. Wallich mentions them as "five villous protuberances." DeCandolle completely ignores them. Bentham & Hooker, Gen. Pl. 2: 864 (1876), describes them succinctly as follows: "staminibus plicis seu gibbis intrusis extus foveolatis affixis." Another feature of the corolla is the manner in which its puffed-out longitudinal ribs abruptly terminate directly opposite the base of the calyx-sinus. This abruptly contracted base forms a chin which rests in the angle between the adjacent calyx-lobes. Above the base the ribs are very prominent, bulging out and noticeably protrudent between the lobes of the calyx. This remarkable condition is referred to in earlier descriptions only by DeCandolle and by him only indirectly as "costis 5 obtusis basi saccatis."

The closest relative of *O. emodi* is *O. Wallichianum*, a species with a more slender growth-habit, less persistent root, and slightly smaller but otherwise similar corolla. Other species obviously belonging to the same circle of relationship are *O. verruculosum*, *O. Borii*, *O. lycopsioides*, *O. microstoma*, *O. dumetorum*, *O. bicolor*, and *O. egregium*. These all have a similar calyx and an apically constricted corolla which bears puffed-out ribs and depressed areas below the middle. They differ from *O. Emodi* and *O. Wallichianum* in lacking well-developed invaginated protuberances within the corolla as well as in the more elongate corolla-form and less exaggerated ribs and depressions. Their close relationship with *O. emodi*, however, is beyond doubt.

The plant which Wallich described as *O. emodi* is different from that which he subsequently catalogued under that name (sub no. 940) in his Numerical List. The plant described as *O. emodi* is that which was catalogued (sub no. 937) as *"Onosma vestitum."* The plant (no. 940) incorrectly identified as *O. emodi* was subsequently given the name *O. Wallichianum*, by DeCandolle.

36. **Onosma Wallichianum** (DC.) Benth. ex Clarke, Fl. Brit. India 4: 179 (1883).

Maharanga Wallichiana DC. Prodr. **10:** 71 (1846). — Type from Nepal, Wallich [no. 940 from Gossain Than].

Onosma emodi sensu Wall. Numerical List 27, sub no. 940 (1829), not Wall. (1824).

Plant with a slender annual or at most biennal root; stems slender, 3–4.5 dm. long, 1–2 mm. thick towards base, simple or with short floriferous branchlets from the upper leaf-axils, sparsely short-hispid (hairs ca. 1 mm. long) and also sparingly appressed villulose-hispidulose (hairs 0.1–0.3 mm. long); leaves green above, paler beneath, obscurely triplinerved, bearing sparse slender appressed bristles 1–1.5 mm. long and also minute appressed hairs 0.1–0.3 mm. long; hairs arranged singly or numbers of very minute hairs borne on the thickened base of the bristles and stellately

arranged, especially so on the lower leaf-face; cauline leaves 3–5 cm. long, 6–10 mm. broad, oblanceolate, apex broadly acute; basal leaves not seen; cymes small, terminal, 1.5–2.5 cm. broad; calyx at anthesis 3.5–4 mm. long, lobes cuneate to broadly cuneate, 2.5–3 mm. long, acute, 1–1.5 mm. broad at base, densely appressed villose on inner face, outside sparsely hispid and minutely strigulose; pedicels 1–5 mm. long; corolla in form and organization similar to that of *O. emodi,* differing only in size; corolla 8 mm. long, 6.5–7 mm. thick, obese, with lower end of puffed-out ribs forming gibbose projections protruding between the calyx-lobes; anthers 3.5 mm. long; filaments 0.8–1 mm. long, arising from a protuberance 3.5 mm. above the base of the corolla; nectary a collar 0.6–1 mm. high.

NEPAL: Gossain Than, *Wallich 940* (Ed, ISOTYPE).

This species has the growth habit of *O. bicolor* and *O. egregium* and the floral organization of *O. emodi.* The corolla, though perceptibly smaller, and perhaps also of more delicate texture, is otherwise a replica of that of *O. emodi.* It is broader and more obese than that of *O. bicolor* and *O. egregium* and its puffed-out ribs are more protrudent and the protuberances inside are conspicuously rather than inconspicuously developed. In vegetative characters *O. Wallichianum* most resembles *O. egregium.* The foliage in these two is thinner than in *O. bicolor,* and furthermore, their sparser indument consists in part of more or less well developed stellate hair-clusters. In *O. bicolor* the hairs all occur singly. In *O. egregium* numerous straight minute hairs arise on and diverge stellately from the mineralized disk at the base of certain of the bristles on the leaf-surface. The same condition occurs in *O. Wallichianum* but is less well developed, the stellately arranged hairs being not only smaller but also more slender and even contorted rather than straight. Furthermore, the number of minute hairs on the mineralized disk is frequently reduced to few or even one.

37. **Onosma bicolor** Wall. Numerical List 26, sub no. 939 (1829), nomen; G. Don, Gen. Syst. **4:** 317 (1838); Clarke, Fl. Brit. India **4:** 179 (1883). — Type from Gossain Than, Nepal, *Wallich 939.*

Maharanga bicolor (Wall.) DC. Prodr. **10:** 71 (1846).

Plant with one to several stems from a firm slender (1–3 mm. thick) annual or possibly biennial root; stems 15–40 cm. long, usually 1–3 mm. thick, apparently decumbent or sprawling, simple or with a few leafy floriferous branchlets above the middle, usually bristly (hairs 1–3 mm. long) and also minutely and retrorsely strigulose; leaves frequently more or less evidently triple-nerved, with slender appressed hairs 2–3 mm. long, those on upper surface usually with pallid bases, minute hairs strigulose; lower cauline leaves oblanceolate, apex obtuse, from above middle gradually narrowed towards the attachment, 2–6 cm. long, 5–12 mm. broad; upper cauline leaves lanceolate or elliptic, usually 1.5–5 cm. long, acute; cymes 2–3 mm. broad, terminal, usually forked, at anthesis glomerate, at maturity loosely racemose; calyx 5–7 mm. long, lobes cuneate to narrowly

triangular, 2.5–4.5 mm. long, 1.5–2 mm. broad at base, inner surface with abundant appressed straight white hairs, outer surface bristly; pedicel slender, 3–7 mm. long; corolla 9–12 mm. long, barrel-shaped, twice as long as broad, broadest near middle (4–6 mm.), base 1.5 mm. thick, below the middle with narrow but evident ribs protruding slightly between the calyx-lobes, outer surface with short appressed hairs, inner surface hairy on stamen-bases and on tube below; corolla-lobes recurving, triangular, 0.7–1 mm. broad, 0.5–0.8 mm. long; anthers 3–4 mm. long, coherent at base, included, affixed 0.6–0.8 mm. above base, sterile tip 1 mm. long denticulate; filament 1.7–2.5 mm. long, cuneate, the broad base arising from an inconspicuous invaginated protuberance 3–4.5 mm. above corolla-base; nectary a collar, 0.9–1.1 mm. high, inner surface hairy; style 7–10 mm. long, glabrous; nutlets erect 1.5 mm. long, brown, dull, tuberculate and also minutely and very abundantly papillate, base truncate.

BHUTAN: Paro, 7750 ft., July 11, 1938, *B. J. Gould 981* (K).

TIBET: Pun-ka-bee-see-mo, Chumbi, fl. white, July 24, 1884, *King's Collector 173* (DD); Yatung, lat. 27°51′, long. 88°35′, *H. E. Hobson* (K).

SIKKIM: without locality [? Lachen], 9–10000 ft., *Hooker* (G).

NEPAL: Gossain Than, *Wallich 939* (K, ISOTYPE); without locality, *Dr. J. Scully* (Ed, DD).

A species closely related to *O. egregium* and *O. Wallichianum*, differing from both in having firmer leaves that are more abundantly clad with non-clustered hairs. Its barrel-shaped corolla further distinguishes it from *O. Wallichianum*. All three species have a similar weak annual or at most biennial root, conspicuously different from the coarse strong perennial root of *O. emodi*. DeCandolle has suggested, as regards the type of *O. Wallichianum*, that this root-condition may be that of a juvenile plant or at least one growing in unfavorably wet or shaded conditions. Two of the collections of *O. bicolor* examined (Nepal, *Scully;* Chumbi, *King's col. 173*) show well-developed plants with roots. The roots are slender as I have described them. As far as can be compared the other collections of *O. bicolor* cited are so similar to those with roots that I feel certain that their underground parts were also similar. I find it hard to believe them only ecological forms of *O. emodi*.

38. **Onosma egregium**, sp. nov.

Planta e radice palari gracillima oriens ut videtur annua vel biennis; caulibus plus minusve simplicibus 2–3.5 dm. longis basim versus 1.5–3 mm. crassis hispidis (pilis simplicibus gracilibus pallidis 1.5–3 mm. longis) et retrorse strigulosis (pilulis 0.1–0.5 mm. longis); foliis caulinis oblanceolatis non rare venosis 4–8 cm. longis 8–18 mm. latis supra medium latioribus, apice acutis, basi acutis sessilibusque vel 1–3 mm. longe petiolatis acutisque, facie superiore viridibus indumento sparsissime donatis adpresse hispidis et minutissime hispidulis, pilis majoribus 1–2 mm. longis e centro disci pallido erumpentibus plerumque basi pilulos 0.1–0.4 mm. longos pluros radiate dispositos disco pallido marginem versus erumpentes cir-

cumdatis, pilulis 0.1–0.4 mm. longis dispersis vel stellato-aggregatis, facie inferiore foliorum indumento ei faciei superioris simili vel pilulis stellato dispositis nullis vel raris praeditis; cymis terminalibus 1.5–2.5 cm. latis; calyce 6–7 mm. longo, tubo cupuliformi, lobis cuneatis 4–5 mm. longis basi 1–1.5 mm. latis; corolla eis *O. bicoloris* simili 8–10 mm. longa utroque contracta basi 1.5–2 mm. crassa medium versus vel infra medium crassissima (4–5 mm. crassa), ore 1–3 mm. diametro, extus sparsissime retrorseque strigulosa, infra fundos sinuum sulcata, infra medium costis inflatis et areolis planis ellipticis (apice plus minusve invaginatis) ornata; lobis triangularibus reflexis 1 mm. latis 0.8 mm. longis; antheris 4–4.5 mm. longis, inclusis, basi cohaerentibus, ca. 1 mm. supra basim affixis, apicibus sterilibus serrulatis ad 0.5 mm. longis; filamentis angustissime cuneatis 1–1.5 mm. longis medionervatis e gibbis intrusis 3 mm. supra basim corollae orientibus basim versus sparse villulosis; nectario 1 mm. alto intus villulosis; stylo 7–8 mm. longo glabro; nuculis ignotis.

INDIA (Kumaon): Palang garb, Byans, ca. 10000 ft., July 19, 1880, *J. R. Reid* (TYPE, Edinburg); Palang Gadh, Byans, 10000 ft., July 19, 1886, *Duthie 5826* (DD).

Most closely related to *O. bicolor* with which it agrees in flower and general habit. It differs in having the more scanty indument on its thinner leaves composed in part of stellate hair-clusters. Such hair-clusters occur in only one other species in our area, in the related *O. Wallichianum*, where they are less well developed. To the naked eye the leaves of these species appear to have an indument in no way distinctive, but under ten to twenty diameters of magnification their clustered hairs are readily apparent. The development of such clustered hairs in these allies of *O. emodi* is of some interest since the presence or absence of such trichome-groups are criteria upon which the primary divisions of the genus traditionally have been made. It is certain that the many diverse species with stellately arranged hairs which occur beyond our limits, in the Middle East and westward into southern Europe, are not closely related to our Himalayan plants. To associate them with the extralimital species because of trichomes would do violence with natural relationships. The traditional primary divisions of the genus, based solely on trichomes, may be convenient, but their naturalness is questionable.

UNPLACED SPECIES

ONOSMA AFGHANICUM Bornmüller, Bot. Jahrb. 66: 234 (1934). — Type from Afghanistan, "Kabul, auf dem Berge Babur, 1800 m.," July 15, 1929, *Constantin Manger*.

Not recognized from the description. The few details given concerning the flower are as follows, — corolla, flava, calyce vix quatra longiore, 20–21 mm. longa, glabra, lobis breviter triangularibus reflexis; antheris apice breviter exsertis; filamentis brevissimis; stylo 24 mm. longo.

ONOSMA VERSICOLOR Griffith, Posthumous Papers 1: 407 (1847) and 2: 315 (1848). — Type from Afghanistan; Erak ravine, mountains ca. 100 km. westerly from Kabul, *Griffith*.

The few notes regarding this plant given by Griffith are inadequate for recognition: "1175. *Onosma versicolor* — Floribus initeo ochroleucas, demum atro sanguineis velutinis. Erak ravine, in flower, about snow 11500 ft., over the pass as high as 12000 ft." In his Journal, op. cit. 407, Griffith mentions *Onosma versicolor* as one of the plants growing about his camp near the head of Erak ravine on Sept. 8th.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

PLANTAE PAPUANAE ARCHBOLDIANAE, XX *

LILY M. PERRY

THIS PAPER embodies an attempt to name and record the New Guinean collections of *Elatostema* at hand. The genus, as here accepted, is that delineated by Hilde Schröter & Hubert Winkler in Rep. Sp. Nov. Beih. 83 (1, 2), which, as far as I have discovered, is the latest monographic work on the genus. In it *Elatostema* is interpreted as having three subgenera in our area: Euelatostema, Pellionia, and Elatostematoides. In the second part of the monograph the last two are completely revised; apart from two new species described by H. Schröter in Rep. Sp. Nov. 47: 221, 222. 1939, I have have found nothing on Euelatostema later than Hub. Winkler's treatment in Bot. Jahrb. 57: 520–566. 1922, and an enumeration following this in Nova Guin. Bot. 14: 121–128. 1924. In both of these Hub. Winkler included the genus *Procris* as a subgenus; however, in the latest study this is maintained as a separate genus. At best *Elatostema* is a difficult genus, but now much more so because of the fact that our material has been on loan to Breslau since 1935 and has not been returned even though frequent requests for its return have been made. Hence there has been very little authentic material available for comparison, and practically all the work has been done with only the published descriptions for reference.

I am indebted to Dr. E. D. Merrill for comparing several fragments with Ridley's types from the Wollaston Expedition to Dutch New Guinea which are located in the British Museum. I am grateful to Dr. David D. Keck, Head Curator of the Herbarium of the New York Botanical Garden, for a small but helpful loan of Malaysian material. As always, I am most appreciative of the fine courtesy of Dr. Reed Rollins in making available for study the material in the Gray Herbarium. Unless otherwise indicated the collections cited belong to the Arnold Arboretum.

SUBGEN. EUELATOSTEMA

Elatostema platycarpum sp. nov.

Herba circiter 1 m. alta; caule crasso apicem versus 3 mm. deorsum 5 mm. diametro de nodo ad nodum valde sulcato pubescente vel subtomentoso, internodiis 1–4 cm. longis, stipularum cicatricibus incompleto annulatis; foliis chartaceis sessilibus 16–36 cm. longis, 7.5–11 cm. latis, obovato-oblongis acuminatis, acumine ad 2 cm. longo, integro, inaequilateralibus basin versus angustatis, basi valde obliquis, latere angustiore ultra basin fere 1.5 cm. cuneatis, in eodem loco latere latiore circiter 5 mm.

*Botanical Results of the Richard Archbold Expeditions. See Jour. Arnold Arb. 30: 139–165. 1949.

latis basi ima auriculatis auriculo caulem partim tegente, margine argute serrato-dentatis, supra asperis rugulosis vel subbullatis parce pubescentibus et copiose punctulatis, subtus parce costa et nervis densius patenti-pilosis, utrinque cystolithis gracilibus, penninerviis, nervis lateralibus utrinsecus 14–16 oblique arcuato-adscendentibus, rete perspicuo; stipulis membranaceis hyalinis lanceolatis 4 cm. longis acuminatis, extus pubescentibus; inflorescentiis ♂: non visis; inflorescentiis ♀: (sicco) usque 5 cm. diametro, interdum ut videtur lobatis et maturitate probabiliter subpulvinatis pedunculatis, pedunculo usque 1.5 cm. longo; bracteis confluentibus tantum margine 2.5–3 mm. liberis, costa obtuse carinatis pubescentibus, bracteolis liberis circiter 1.5 mm. longis sub apice umbonulatis pubescentibus; pedicellis 0.5 mm. longis; perigonii segmentis minutis; achenio 0.5 mm. longo ovoideo, obscure 3–5-angulato.

NORTHEAST NEW GUINEA: wet mountain, Wantoat (Wantot), alt. 1050–1800 m., *Clemens 11046b*, Jan. 1940; Matap, alt. 1500–1800 m., *Clemens 41115*, Feb.-Apr. 1940; wet rocky trail, Yunzaing, alt. about 1500 m., *Clemens 4205*, Aug. 1936; margin of stream, Ogerannang, alt. about 1650 m., *Clemens 4962*, Jan. 1937.

NETHERLANDS NEW GUINEA: on bank of stream in rain-forest, not common, 6 km. SW. of Bernhard Camp, Idenburg River, alt. 1200 m., *Brass 12947* (TYPE), Feb. 1939 (stout fleshy herb ±1 m. high; stem ribbed, unbranched; leaves rugose).

This species agrees with the description of *E. finisterrae* Warb. in the large rough sessile leaves with prominent venation on the lower surface, and the large caducous stipules. In the latter, however, the leaves are described as ovate (but broadest above the middle) and subacute, and, according to the measurements given, are only twice as long as broad; whereas those of *E. platycarpum* are obovate-oblong, acuminate, and three times as long as broad. The cystoliths in the type and in *Clemens 11046b* and *41115* are fine and white; those in *Clemens 4205* and *4962* are slightly coarser and yellowish.

I did not find any staminate inflorescence in the Brass collection. In *Clemens 4962* an attached inflorescence appears to be half staminate and half pistillate. In the pistillate part the achenes seem to be nearly mature; on the other hand only a few of the staminate flowers have reached anthesis.

Elatostema elegans Hubert Winkler in Bot. Jahrb. 57: 526. 1922, vel aff.

NETHERLANDS NEW GUINEA: rain-forest; plants forming dense, rounded, flood-resistant clumps in the stony bed of a stream, also gregarious on flood-swept banks of river, 4 km. SW. of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13073, 13224*, March 1939 (thick, ribbed, branched stems 60 cm. long; leaf-veins red on the lower surface).

These two collections show considerable variation in the serration of the leaves even on the same specimen; the teeth from apex to sinus may be 1.7 mm. broad on some leaves, while on other they are barely 0.5 mm. It should also be pointed out that the serrations do not extend to the apex of the acumen nor to the lowest base of the leaf, as has been described

in the original. Furthermore, the ♀ inflorescence is not nearly so small as that of the type. No indication is given whether it is peduncled or not. In the specimens at hand which, I believe, belong either to this species or are very closely related to it, the ♂ inflorescences are mostly immature (a few have open flowers) and may be as large as 1 cm. diameter, on a peduncle up to 5 mm. long; the outer bracts are confluent, the margins free for about 2 mm., and somewhat keeled; bracteoles are obovate and obtusely keeled or umbonate just below the apex. The ♀ inflorescence is about the same size as the ♂, on a peduncle up to 3 cm. long; the achene is about 0.7 mm. long and straw-colored with minute linear dots running longitudinally over the surface.

Elatostema macrophyllum var. **majusculum** (K. Schum.) Hubert Winkler in Bot. Jahrb. 57: 526. 1922.

Elatostema frutescens var. *majusculum* K. Schum. in K. Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee Nachtr. 253. 1905.

NORTHEAST NEW GUINEA: Sattelberg, *Warburg 20775*, March-April 1889; gregarious on bank of trail in forest, Ogeramnang to Bulung, alt. about 1650 m., *Clemens 4903*, Jan. 1937 (plant 15 inches to 2 ft.); wet places in bush by the Kajabit Mission, Markham Valley, alt. 240–600 m., *Clemens 10540, 10765*, Aug.-Dec. 1939 (plant 2 ft. high; flowers pale); Boana, alt. 750–1350 m., *Clemens 41415, 41793*, May-Nov. 1940 (plant 2–3 ft. high).

BRITISH NEW GUINEA: gregarious in semi-shade along river banks, Palmer River, 2 miles below junction Black River, alt. 100 m., *Brass 6913*, June 1936 (very large pale fleshy species over 1 m. high; stem deeply fluted between the nodes, pink when cut).

Elatostema retinervium sp. nov.

Herba circiter 1 m. alta; caule apicem versus 3 mm. deorsum 5 mm. diametro, inconspicue sulcato adpresse piloso deinde glabrescente, internodiis 2–4 cm. longis, stipularum cicatricibus indistincte annulatis; foliis chartaceis vel subcoriaceis sessilibus 16–21 cm. longis 5–7 cm. latis, oblongis leviter obovatis, subfalcatis, valde inaequilateralibus, utrinque angustatis, acuminatis, acumine 2 cm. longo, basi valde obliquis latere angustiore supra basin 1–1.5 cm. truncato-cuneatis, latere latiore basi ima auriculatis, auriculo caulem tegente, margine (auriculo et acumine inclusis) argute serrato-dentatis, supra bullatis et rugulosis fere glabris (glandulis barbulatis), cystolithis copiosis, subtus costa et venis adpresse pilosis, ceterum glabris, cystolithis in costa et venis obsitis; nervis lateralibus utrinsecus 10–15 obliquis arcuatim conjunctis rete conspicuo; stipulis hyalinis lanceolatis 2.5–3 cm. longis, extus costa praecipue pubescentibus; inflorescentiis ♂: pedunculatis magnis 1.5–2 (interdum 3) cm. latis, vix 1 cm. longis ante anthesis, pedunculo ad 2.3 cm. longo dense piloso; bracteis ut videtur confluentibus tantum margine circiter 3.5 mm. liberis, pubescentibus, parte superiore carinatis et corniculatis; bracteolis spathulatis ad 5.5 mm. longis prope apicem subcarinatis et umbonulatis, apice et dorso superiore linea media subrigide pilosis; floribus ♂ pedicellatis,

pedicello fere 4 mm. longo; perigonii segmentis 4 circiter 2–2.5 mm. longis apice pilis paucis ornatis, duobus oppositis vix 0.2 mm. corniculatis, duobus alteris paulum latioribus circiter 0.5 mm. corniculatis; inflorescentiis ♀: non maturis, ut videtur sessilibus; floribus pedicellatis; perigonii segmentis 3 inaequalibus quam ovario brevibus gracillimis.

NETHERLANDS NEW GUINEA: gregarious in undergrowth of flood-plain forest, Bele River, 18 km. NE. of Lake Habbema, alt. 2200 m., *Brass 11318* (TYPE), Nov. 1938 (very fleshy and ±1 m. high; stem not branched; leaves rugose).

I hesitate to suggest which is the closest relative of this species. It seems rather near *E. serra* Winkler except that the venation of the leaves is pinnate, not trinerved. The latter species lacks any indication of the roughish bullate upper leaf-surface which is so characteristic of *E. retinervium*. Here these slightly raised points are tufted with very short hairs (barbulate), and perhaps indicate the presence of a gland or possibly a hydathode, of which there may be one or more in each areola; the venation is impressed above but prominent on the lower surface. Among the close relatives in the pinnate-veined species of the genus are *E. finisterrae* Warb. and *E. platycarpum* Perry. It differs from the latter in its smaller, less obovate, firmer-textured, and more distinctly bullate leaves with the pubescence on the venation of the lower surface appressed rather than loosely spreading. It differs from *E. finisterrae* in the very obviously pedunculate ♂ inflorescence.

Elatostema vicinum sp. nov.

Planta non 1 m. alta, ramosa; caulibus apicem versus hirtellis deorsum glabrescentibus in sicco sulcatis, internodiis superioribus 1.5–3 cm. longis 1.5–3 mm. diametro, inferioribus non visis; foliis tenuiter chartaceis, sessilibus, obovatis, 9–11.5 cm. longis, superiore ⅓ circiter 3.5–5 cm. latis (ramulorum 3.5–6 cm. longis, 1.3–2.5 cm. latis), inaequilateralibus, basi valde obliquis latere latiore auriculatis, auriculo caulis crassitudinem superante, latere angustiore obtusis, omni margine acute serratis, serraturis saepe iterum semel vel bis leviter serratis, apice subabrupte acuminatis, acumine 1–1.5 cm. longo, supra glabris, cystolithis minimis praecipue in costa et nervis ornatis, subtus laxe hirtellis, penninerviis, nervis lateralibus utrinsecus 7–9 supra manifestis subtus prominulis secundariis et rete utrinque manifestis; inflorescentiis ♂: axillaribus, sessilibus vel subsessilibus, 1–1.5 cm. diametro, bracteis ± confluentibus, sub apice carinato-corniculatis, bracteolis linearibus apice pilosis; floribus pedicellatis, perigonii segmentis 4 vix 1.5 mm. longis sub apice 0.7 mm. corniculatis; inflorescentiis ♀: non visis.

BRITISH NEW GUINEA: common in forests of limestone country, Mafulu, alt. 1250 m., *Brass 5198* (TYPE), Sept.-Nov. 1933 (floor plant under 1 m.; stems fleshy, terete; leaves thin, dark green; inflorescence white).

Amongst the species of New Guinea this is probably nearest to *E. serra* Hub. Winkl., but the latter is described as having oblong-lanceolate leaves, whereas here the leaves are broadest in the upper third, hence obovate.

On account of the slender little horns on the perianth parts and the coarse serration of the leaves I tried to place it in *E. rugosum* A. Cunn. of New Zealand, but in that species the leaves taper very gradually to the apex, while in the Brass specimen the leaves narrow more abruptly into a short acumen. The original reference to *E. rugosum* in our copy of the Kew Index reads as if pl. 9, f. 5–8 belongs to Ann. Nat. Hist., when as a matter of fact it belongs to Archiv. Mus. Hist. Nat. Paris. I have checked the original publication to verify this, only to find myself disappointed not to find any plate at all accompanying the description.

Elatostema reticulatum Weddell in Ann. Sci. Nat. ser. 4, **1**: 188. 1854.

SOLOMON ISLANDS: Bougainville: rain-forest, Kupei Gold Field, alt. 950 m., *Kajewski 1624*, April 1930 (very fleshy-leaved plant up to 50 cm. high).

As far as I can see from the description and a couple of specimens from Australia in the Gray Herbarium, this plant represents the above Australian species.

Elatostema salomonense sp. nov.

Planta circiter 35 cm. alta; caulibus, ut videtur, non ramosis, adpresse pubescentibus deorsum glabrescentibus, 1–1.5 mm. diametro, sulcatis, internodiis superioribus 0.8–1.5 cm. inferioribus usque 4 cm. longis; foliis subsessilibus (petiolo vix 5 mm. longo), chartaceis, oblique ovatis vel lanceolatis vel interdum leviter obovatis, 7–20 cm. longis, 2.7–6 cm. latis, valde inaequilateralibus, acuminatis, acumine 1.5–3 cm. longo basi tantum crenato (inferioribus vix acuminatis), basi obliquis, latere latiore leviter cordatis vel breviter auriculatis, auriculo non caulem tegente, latere angustiore angustatis deinde abrupte cuneatis, margine superiore $\frac{2}{3}$ crenato-dentatis, supra glabris cystolithis profuse adspersis, subtus costa et nervis dense adpresse pubescentibus pallidioribus, semipenninerviis (basi trinerviis), nervis lateralibus supra basalibus utrinsecus 4 vel 5 arcuato-adscendentibus, secundariis utrinque manifestis; stipulis 5–10 mm. longis, lanceolatis, acuminatis, tarde caducis; inflorescentiis ♂: circiter 7 mm. latis, 5 mm. longis, dense adpresse pubescentibus, usque 1 cm. pedunculatis, bracteis apicem versus carinato-corniculatis, bracteolis angustioribus carinatis apicem versus minute pubescentibus; floribus pedicellatis, perigonii segmentis 5 oblongis sub apice minute corniculatis pilis paucis ornatis; inflorescentiis ♀: non visis.

SOLOMON ISLANDS: San Cristobal: on forest paths, sides of ravines, lowlands, Waimamura, *Brass 2643* (TYPE, Gray Herb.), Aug. 1932 (very common; whole plant very fleshy; stems corrugated).

This species seems to be most like the Philippine species, *E. simulans* C. B. Rob. It differs from the latter in having larger leaves with longer acumen, longer stipules, pubescent rather than setose stem, and shorter hornlets on the perianth-parts of the staminate flower.

Another collection which belongs in this general alliance, but apparently not identical with either, is *Brass 5374*, floor of tall forest, Mafulu, alt.

1100 m. This specimen is sterile except for one very small pistillate inflorescence.

Elatostema novo-guineense Warb. in Bot. Jahrb. 13: 290. 1891.

NORTHEAST NEW GUINEA: forest hill, Sattelberg, alt. about 1000 m., *Clemens 3098;* Ogeramnang, alt. about 1750 m. and 1650 m., *Clemens 4682, 4961, 4976, 4999,* Jan. 1937; Sambanga, alt. 1500–1800 m., *Clemens 7075* in part, *7214,* Sept. 1937; Wantoat, alt. 1050–1800 m., *Clemens 10924,* Jan. 1940; Patema, 40 km. inland from Nabire, alt. 300 m., *Kanchira & Hatusima 12432,* Mar. 1940; 4 miles south of Langemak Bay (vicinity of Finschhafen), *Sawyer 98,* Apr. 1945; Lae, *Clemens 10435,* July 1939; Boana, alt. about 1050 m., *Clemens 41560* (U. of Mich.), July 1940; Yunzaing, alt. about 1500 m., *Clemens 3467, 3775, 4046,* June, Aug. 1936; vicinity of Kajabit Mission, *Clemens 10784,* Aug.-Dec. 1939; Gaeng, alt. 1350 m., *Clemens 41292* (U. of Mich.), Aug. 1940.

This enumeration of specimens must be considered as belonging to *E. novo-guineense* sensu lato. They vary considerably; some tend to be more pubescent than others; again, quite a number have a long acumen and are dentate or serrate-dentate only on the upper half, while others from the same locality may be very shortly acuminate.

We have at hand for comparison *Schlechter 16741,* named var. *angustifolium* Warb., but cited by Winkler under the species, and *Warburg 20774* from Sattelberg, probably an isotype of var. *angustifolium* Warb. I cannot see any difference in the two.

Another collection with staminate inflorescence on a peduncle 5 cm. long, but with apparently entire leaves (as far as I can see not differing otherwise), is *Brass 5387,* from stream banks in lower primary forest, Mafulu, Central Division, alt. 1250 m.

Elatostema belense sp. nov.

Planta 30–40 cm. alta sparsim ramosa; caulibus et ramulis adscendentibus pilosis vel glabrescentibus in sicco leviter sulcatis; foliis subsessilibus (petiolo circiter 1 mm. longo) lanceolato-oblongis 6–11 cm. longis, 1–3 cm. latis (ramulorum 2–4 × 0.6–1.1 cm.), leviter inaequilateralibus, apice acuminatis vel interdum acutis, basi obliquis latere angustiore obtusis, latere latiore rotundatis fere subcordatis margine superiore ⅔ vel ½ grosse et acriter dentatis ceterum integris utrinque pilosis (pilis leviter rigidis) vel glabrescentibus, penninerviis, nervis lateralibus utrinsecus 5–8 oblique adscendentibus; stipulis hyalinis pilosis oblongis, 5 mm. longis acutiusculis; inflorescentiis ♂: pilosis, 8–10 mm. diametro, pedunculatis, pedunculo 2–2.5 cm. longo; bracteis 2 exterioribus late ovatis 6–7 mm. longis, valde carinatis sub apice cornutis, cornu 2 mm. longo, interioribus paulo minoribus, bracteolis spathulato-oblongis; floribus ♂ 2 mm. pedicellatis, perigonio 4-fido, 2 mm. longo, segmentis sub apice circiter 0.5 mm. corniculatis; inflorescentiis ♀ usque 6 mm. diametro, sessilibus vel subsessilibus, dense pilosis vel glabrescentibus, bracteis illis ♂ similibus sed minoribus, bracteolis fere linearibus apicem versus pilosis, floribus ♀ (submaturis) circiter 0.5 mm. pedicellatis, perigonii segmentis minutis

vix visis, staminodiis 3 distincte manifestis; achenio ovali utrinque angustato, 2.5–3 mm. longo, 1–1.1 mm. lato, circiter 8-costato.

NETHERLANDS NEW GUINEA: not common, on shady flood-banks of a forest creek, Bele River, 18 km. NE. of Lake Habbema, alt. 2200 m., *Brass 11317* (TYPE), Nov. 1938; frequent in flood-plain forest, Bele River, 18 km. NE. of Lake Habbema, alt. 2200 m., *Brass 11263*, Nov. 1938.

In the relatively long-peduncled staminate inflorescence the species suggests *E. novo-guineense* Warb., but the leaves differ in outline, the acumen is much shorter, and the teeth of the leaves deeper and sharper; further, the stipules are oblong and acutish rather than lanceolate and acuminate. The horns of the inflorescence protrude beyond the margin of the bracts rather than being even with it or shorter as shown in the figure of *E. macropus*. The pubescence in *Brass 11317* is more profuse and mostly longer than that of *Brass 11263*, which has a definite tendency to be glabrous on the older parts of the plant.

Elatostema urvilleanum Brongniart in Bot. Voy. Coq. 210, *pl. 46, f. A.* 1829.

SOLOMON ISLANDS: San Cristobal: coral limestone soil near beach, Waimamura, *Brass 2555*, Aug. 1932 (plentiful; attaining 60 cm. in height; whole plant very fleshy).

This plant looks like a very good match for the plate of this Moluccan species.

Elatostema schroeteri nom. nov.

Elatostema serratifolium Hilde Schröter in Rep. Sp. Nov. **47:** 221. 1939; non Elmer (1934).

We are fortunate enough to have at hand three of the collections cited (*Clemens 5992, 6832, 7458*) in the original description; in fact we have four, but *Clemens 7075* is a mixture, and only part of it belongs to this species.

Elatostema schroeteri var. **angustilimbum** var. nov.

Ramulis novellis patenti-pilosis; foliis anguste lanceolatis (6–12 × 1.2–2 cm.) longe acuminatis, acumine 2–2.5 cm. longo, subtus primum costa et nervis lateralibus deinde costa tantum patenti-pilosis, cystolithis supra copiosis.

NETHERLANDS NEW GUINEA: characteristic undergrowth on moist, rocky slopes in Fagaceae forest, Bele River, 18 km. NE. of Lake Habbema, alt. 2300 m., *Brass 11339* (TYPE of var.), Nov. 1938 (40–60 cm. high).

This variety differs from the species in its narrower leaves with longer acumen, and in the loose and widely spreading pubescence of the branchlets and the midrib and nerves on the lower leaf-surface. The cystoliths are much more profuse in the variety, but I have been unable to determine whether this is a constant feature, in fact, I suspect that it is not.

Elatostema kupeiense sp. nov.

Planta 50 cm. alta fere glabra ramosa; ramis tenuibus in sicco 2.5 mm. diametro, ramulis tenuioribus, internodiis ramulorum 5–10 mm. longis prope apicem minoribus; foliis tenuiter chartaceis subsessilibus (petiolo 0.5–2 mm. longo), oblongo-lanceolatis, 3–6 cm. longis, 0.9–1.5 cm. latis, basi obliquis, latere angustiore obtusis, latere latiore rotundatis vel subauriculatis, sursum fere inciso-serratis, serraturis 5–9, margine tantum prope basim et apice integris, acumine 1–1.7 cm. longo basi 2–3 mm. lato, utrinque glabris (novellis subtus costa pilosulis), penninerviis, nervis lateralibus utrinsecus 5–9 oblique adscendentibus utrinque manifestis, subtus rete manifesto, cystolithis minimis adspersis; stipulis linearibus acuminatis, circiter 6 mm. longis, tarde deciduis; inflorescentiis ♂: circiter 7 mm. diametro, axillaribus, pedunculatis, pedunculo 1–3 cm. longo, bracteis exterioribus 5.5 mm. longis (cornibus 3 mm. inclusis), late ovatis sub apice carinato-cornutis, interioribus angustioribus carinato-corniculatis, corniculo 0.7 mm. longo, carina sparsim et subrigide pilosula; floribus 1.5 mm. pedicellatis, perigonii segmentis 2 mm. longis, 0.7 mm. corniculatis; inflorescentiis ♀: axillaribus sessilibus, tantum 3–4 mm. diametro, bracteis et bracteolis 2–2.5 mm. longis, rigide pilosulis et corniculatis; floribus vix 1 mm. pedicellatis, perigonii segmentis 3 minutis brunnei-glandulosi-adspersis, staminodiis minutis, achenio ovali-fusiforme, circiter 1 mm. longo vix 0.5 mm. diametro.

SOLOMON ISLANDS: Bougainville: rain-forest, Kupei Gold Field, alt. 950 and 1000 m., *Kajewski 1678, 1696* (TYPE), April 1930 (very fleshy plant).

This species appears most closely allied to *E. acuminatum* Brongn., but in the latter entity the base of the leaf is described as acute, and the lateral nerves appear to extend direct to the first dentation above them. In *E. kupeiense*, on the other hand, each nerve appears to extend into the second dentation above its separation from the midrib.

Elatostema rudicaule Hub. Winkler in Bot. Jahrb. 57: 540, *fig. 6*. 1922.

NORTHEAST NEW GUINEA: forest hill by water supply, and near clearing west of village, Ogeramnang, alt. about 1740 m., *Clemens 4576, 5016*, Dec. 1936 and Jan. 1937.

BRITISH NEW GUINEA: plentiful on wet banks of a small stream, Mt. Tafa, alt. 2400 m., *Brass 4830*, May-Sept. 1933 (fleshy shrub about 0.5 m., stem 4-angled, upper side fluted).

These collections vary considerably in the size of the leaves (2–6 × 0.8–1.8 cm.) and the pubescence. In *Clemens 4576* the upper leaves are clothed above with a sparse villosity which probably is lost as the plant matures; the other plants have leaves glabrous on the upper surface; however, all are marked in some degree by the double serration which seems to be the character of this species. Owing to the fact that *Brass 4830* has leaves with simple serrations as well as leaves with double serrations, it has seemed best to regard a specimen from the Netherlands New Guinea as a variety of this species.

Elatostema rudicaule var. **villiferum** var. nov.

Planta 80 cm. alta, ramosa; ramis glabrescentibus, ramulis hirsuto-villosis; foliis 1–2.8 cm. longis, 0.4–0.8 cm. latis, subsessilibus lanceolatis acutis, basi valde obliquis, latere angustiore subtruncatis vel obtusis, latiore auriculatis, serrato-dentatis, dentibus utrinque 7–10 integris, penninerviis, nervis lateralibus hirtellis subrectis eodem numero dentium et in dentibus terminantibus; stipulis lanceolatis hyalinis 3 mm. longis costa pilosulis deciduis; inflorescentiis ♂: sessilibus; bracteis 2 exterioribus circiter 2 mm. longis ovatis obtusiusculis ciliatis sub apice 0.3 mm. corniculatis brunneo-granulosis vel brunneo-lineolatis, interioribus angustioribus sursum pilosulis; floribus ♂ 1.5 mm. pedicellatis; perigonii segmentis 4 vix 1.5 mm. longis apicem versus pilis paucis ornatis et minute corniculatis; inflorescentiis ♀: ei speciei similibus.

NETHERLANDS NEW GUINEA: plentiful in moist hollows in forest undergrowth, Bele River, 18 km. NE. of Lake Habbema, alt. 2300 m., *Brass 11230* (TYPE of var.), Nov. 1938 (plant 80 cm. high; branches spreading).

This plant differs from the species in the simple serration of the leaves and the shaggier pubescence of the branchlets.

Elatostema velutinicaule Hubert Winkler in Bot. Jahrb. **57:** 542. 1922.

NORTHEAST NEW GUINEA: Wantoat (Wantot), alt. 1050–1800 m., *Clemens 11000A*, Jan. 1940.

Elatostema Reiterianum Hub. Winkler in Bot. Jahrb. **57:** 543. 1922.

NETHERLANDS NEW GUINEA: in forest undergrowth, gregarious and covering the ground in wet bottoms, 9 km. NE. of Lake Habbema, alt. 2800 m., *Brass 10295*, Oct. 1938 (plant 50–60 cm. high; leaves rugose).

This collection with pistillate flowers agrees reasonably well with the original description of the species. Pistillate inflorescence: axillary, subsessile, up to 8 mm. broad and somewhat stiffly pilose; outer bracts broadly ovate, keeled along the upper midrib, about 7 mm. long including a minute horn about 1 mm. at the apex; inner bracts narrower and umbonate; bracteoles narrowly spatulate or linear; perianth segments 4, linear, pilose, hardly 0.5 mm. long; staminodes minute; achene ovoid, 1 mm. long, 0.6–0.7 mm. diameter, neither compressed nor angled.

Elatostema sesquifolium (Reinw.) Hasskarl, Cat. Hort. Bogor. 79. 1844. — Weddell in Arch. Mus. Hist. Nat. Paris 9: 308. 1856. — Hubert Winkler in Bot. Jahrb. **57:** 534. 1922.

Procris sesquifolium Reinwardt in Blume Bijdr. 511. 1825.
Elatostema integrifolium in DC. Prodr. **16**(1): 179. 1869.

NETHERLANDS NEW GUINEA: in high rain-forest, Momi, 60 miles south of Manokwari, alt. 50 m., *Kanehira & Hatusima 13291*, March 1940 (plant 60–80 cm. high).

NORTHEAST NEW GUINEA: jungle sidehill, Sattelberg, about 900 m. alt., *Clemens 476*, Oct. 1935; Wantoat (Wantot), alt. 1050–1800 m., *Clemens 11031A*; jungle ravine, 4 miles south of Langemak Bay (vicinity of Finschhafen), alt. about 100 m., *Frank E. Sawyer 102, 120*, April 1945.

BRITISH NEW GUINEA: wet rain-forest floor, Sogeri, about 450 m. alt., *Brass 644*, Nov. 1925 (plant 30–60 cm. high); rain-forest floor, Ihu, Vailala River, *Brass 996*, Feb. 1926.

SOLOMON ISLANDS: Bougainville: creek bank, Kupei Gold Field, *Kajewski 1625*, April 1930.

Elatostema sesquifolium var. **ramosum** Hubert Winkler in Bot. Jahrb. 57: 534. 1922.

NETHERLANDS NEW GUINEA: forming most of the undergrowth in semi-shade on banks of rain-forest streams, alt. 1200 m., *Brass 12946*, Feb. 1939 (slender shrub 1–1.2 m. high; branches spreading).

NORTHEAST NEW GUINEA: Wantoat (Wantot), *Clemens 11032B*, Jan. 1940.

BRITISH NEW GUINEA: common along roadside in light primary forest, Mafulu, alt. 1250 m., *Brass 5418*, Sept.-Nov. 1933 (undershrub less than 1 m. high; leaves dark).

In addition to the specimens cited above as belonging to this species, I should like to call attention to *Clemens 11308 bis* (Univ. of Michigan), Matap, March 1940, in which the leaves are occasionally 1- or 2-incised or lobed. The specimen is very fragmentary, but I believe its alliance is here.

Elatostema humile sp. nov.

Herba 15–20 cm. alta, parce ramosa; caulibus tenuibus apice crispe pubescentibus ceterum glabris, internodiis 3–7 mm. longis; foliis subsessilibus vel breviter petiolatis, petiolo 0.5–1.5 mm. longo, lanceolatis, fere aequilateralibus, 3–5 cm. longis, 0.4–1 cm. latis, apice acutis vel acuminatis basi paulo obliquis, latere angustiore cuneatis, latere latiore obtusis vel subrotundatis, basim versus integris sursum latere latiore 4–8-denticulato-serratis, latere angustiore 3–5-denticulato-serratis maturis glabris, novellis subtus costa crispe pubescentibus ceterum glabris, subpenninerviis basi trinerviis cystolithis linearibus supra adspersis subtus in costa nervisque ornatis; stipulis circiter 5 mm. longis lineari-lanceolatis brunnescentibus hyalinis caducis; inflorescentiis ♂: usque 7 mm. diametro, pedunculatis pedunculo usque 8 mm. longo, axillaribus, bracteis exterioribus late ovatis 3.5 mm. longis latisque sub apice carinato-corniculatis, corniculo 0.5 mm. longo, interioribus minoribus et bracteolis apicem versus pilis rigidis adspersis; floribus 1.5 mm. pedicellatis, perigonii segmentis 5 circiter 2 mm. longis sub apice 0.5 mm. corniculatis; inflorescentiis ♀: circiter 5 mm. diametro, axillaribus subsessilibus bracteis et bracteolis quam ♂ minoribus; pedicellis vix 0.5 mm. longis, perigonii segmentis 4 minutis, staminodiis manifestis; achenio 0.7 mm. longo, elliptico, utrinque angustato, acuto.

NETHERLANDS NEW GUINEA: covering stones and mossy rocks in bed of a small stream in rain-forest, 4 km. SW. of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13271, 13421* (TYPE), March 1939; in high rain-forest, Chaban, 30 km. inland from Nabire, alt. 300 m., *Kanehira & Hatusima 11877*, Feb. 1940.

This species suggests at once *E. tenuicaule* Hub. Winkl. from New

Guinea, and *E. stenophyllum* Merr. from Guam. It differs from both in that the staminate flower is 5-merous. It should also be noted that the dentations are several on the broader side of the leaves of *E. humile* and extend half-way (or more) from the apex (or just below it) to the base, whereas in *E. tenuicaule* they are only two or three and apical.

Elatostema morobense sp. nov.

Planta circiter 15 cm. alta, basi ramosa; ramis adscendentibus tenuibus glabris, 1–1.5 mm. diametro, internodiis 4–6 mm. apicem versus 2 mm. longis; foliis distichis subsessilibus (petiolo 1 mm. longo), 1–1.7 cm. longis, 5–8 mm. latis, oblongis vel obovato-oblongis, inaequilateralibus, basi valde obliquis, latere latiore subcordatis, latere angustiore cuneatis, prope apicem utrinque bidentatis vel latere angustiore tantum uno dente instructis, supra strigulosis, pilis 0.5–0.7 mm. longis pellucidis, cystolithis linearibus vix 0.5 mm. longis, subtus glabris pallidioribus, triplinerviis, nervis lateralibus 2 prope apicem in lobos terminantibus acutis; stipulis lineari-oblongis abrupte acuminatis, 4–6 mm. longis, hyalinis in lineam mediam fulvis glabris, deciduis; inflorescentiis ♂ : non visis; inflorescentiis ♀ : 4–5 mm. diametro sessilibus, bracteis ciliatis subrigide pilosis, exterioribus 2 ovatis, 3.5 mm. longis sub apice circiter 1 mm. corniculatis, interioribus oblongis corniculatis, bracteolis linearibus pilosis; floribus ♀ submaturis 1 mm. pedicellatis, perigonii segmentis 4 minutis, staminodiis 4, ovario oblongo, utrinque paulo angustato, 1 mm. longo, longitudinaliter et interrupte brunneo-lineato.

NORTHEAST NEW GUINEA: Tobou vicinity, *Clemens 6375A* (TYPE), May 1937; high forest trails, banks, etc., Sambanga, alt. 1500–1600 m., *Clemens 6950, 7843*, Sept., Dec. 1937. All from Morobe District.

As far as I can suggest the nearest relative of this species appears to be *E. lingelsheimii* Hub. Winkl. Its striking characters are the glabrous stems, stipules, and lower leaf-surfaces, and the semi-transparent rather coarse hairs (appressed towards the apex of the leaves), which are fairly plentiful on the upper leaf-surfaces; the dentation is confined practically to the apparently broad and slightly oblique apex of the leaves.

Elatostema cupulare Hub. Winkler var. **pedunculatum** var. nov.

Planta quam typus, ut videtur, minus pubescens; foliis 3.7–5.3 cm. longis, 0.8–1.1 cm. latis; inflorescentiis ♂ : 0.5–1.8 cm. pedunculatis.

NORTHEAST NEW GUINEA: in bamboo thicket along bank of a small stream, near Finschhafen, *Reeder 888* (TYPE of var.), Mar. 1944.

The leaves of this variety very closely resemble those of this species shown in Bot. Jahrb. 57: 536, *fig. 4*. 1922; they are, however, slightly narrower, and the staminate inflorescence is pedunculate rather than subsessile.

Elatostema tricanthum Lauterbach in K. Schum. & Lauterb., Fl. Deutsch. Schutzgeb. Südsee Nachtr. 255. 1905, vel aff.

NORTHEAST NEW GUINEA: mossy bush, Upper Camp A, 2700–3000 m., *Clemens 10090*, March 1939.

This collection looks very much like a carbon rubbing of *E. tricanthum* Lauterb. which Dr. Merrill sent me from the British Museum. However, Dr. Merrill does not think that the small plant sent with it for comparison matches it; the original description characterizes the stem as fulvous-villous, whereas in this collection the stems are appressed-pilose with short hairs.

Elatostema podophyllum Weddell in Ann. Sci. Nat. 4, 1: 189. 1854, vel aff.

NETHERLANDS NEW GUINEA: in forest near Iray, Lake Giji, Angi, Arfak mountains, alt. 1900 m., *Kanehira & Hatusima 13799*, April 1940.

This specimen does not have so many cystoliths as the one Philippine specimen which I have seen, but in other characters the two are much alike.

Elatostema poteriifolium Ridley in Trans. Linn. Soc. Bot., ser. 2, 9: 155. 1916, vel aff.

NETHERLANDS NEW GUINEA: common on mossy logs in moist forest of valley bottom and along the banks of streams in forest, 9 km. NE. of Lake Habbema, alt. 2800 m., *Brass 10300, 10550*, Oct. 1938; very abundant in moist gullies, Bele River, 18 km. NE. of Lake Habbema, alt. 2300 m., *Brass 11226*, Nov. 1938 (forest ground herb).

At the British Museum, Dr. Merrill compared a fragment of *Brass 10550* with the type of *E. poteriifolium* Ridl. He wrote me that this is near, but not identical with Ridley's species. He pointed out that there are very long hairs on both the stem and the leaves of the Kloss specimen (the type) and also that the stem is very densely pubescent with a mixture of short and long hairs. In the Brass specimens some leaves are practically glabrous, others have long hairs on them. I suspect this question of pubescence is a variable character; on the other hand I do not find the two types of pubescence on the stems of these collections.

Elatostema mongiense var. **gracile** Hubert Winkler in Bot. Jahrb. 57: 543. 1922.

BRITISH NEW GUINEA: banks of a gully in dense valley forest, not very common, Mt. Tafa, alt. 2400 m., *Brass 5000*, May-Sept. 1933 (stem and branches thick and fleshy).

It is very difficult to place this single specimen with only the brief descriptions of the species and variety at hand. However, with the hope that it may be a help to the next worker on this group I am adding a brief description of this specimen. Plant herbaceous, about 40 cm. tall, the upper part of the stem profusely branched; stem subsulcate and glabrescent, branches and branchlets slender and crisply pilose, internodes of the branches 1–2.5 cm., of the ultimate branchlets about 1–2.5 mm. long; leaves distichous, subsessile, oblong, 3.5–6.5 mm. long, 1.5–2.3 mm. broad, obtuse, strongly oblique at base, on the broader side rounded-auriculate, the auricle covering the very short petiole and the stem, on the narrower side rounded or subtruncate, upwards 2–4 obtusely serrate on the broader

side and 2–3 on the narrower, upper surface glabrous, the lower pubescent along the veins; stipules minute, shortly pilose and caducous; only the ♂ inflorescence seen; flowers single, subsessile, 2-bracted, bracts 0.5 mm. long, lanceolate and shortly pilose; perianth-segments 4 with somewhat rounded apices and just below them minutely horned; stamens 4.

In the solitary staminate flowers and the size of the leaves this plant suggests *E. polypodioides* Ridl.; however, the "conspicuous rounded depressions" on the lower surface of the leaves (as described for Ridley's species) and the trichomes on the "elevations" of the upper surface are lacking.

Elatostema whartonense sp. nov.

Frutex epiphyticus parvus (specimine incompleto 35 cm. longo); ramis 4 mm. diametro sulcatis glabrescentibus, ramulis numerosis fere adpresse hirtellis, internodiis 1–3 mm. longis; foliis distichis 6–9 mm. longis, 2–3 mm. latis, chartaceis subsessilibus (petiolo 0.5 mm. longo) oblongis obtusiusculis et interdum apiculatis, basi valde obliquis, latere latiore auriculatis, auriculo 1–1.3 mm. longo, sursum 1–3 grosse dentatis, dentibus acutis vel obtusiusculis, latere angustiore basi rotundatis et apicem versus uno dente instructis, penninerviis, supra glabris, subtus costa et nervis lateralibus subadpresse hirtellis ceterum glabris, cystolithis prope nervos paucis minimis; stipulis subpersistentibus circiter 3 mm. longis hyalinis lineari-lanceolatis adpresse hirtellis; inflorescentiis ♂: non visis; inflorescentiis ♀: axillaribus paucifloris sessilibus 2–2.5 mm. longis; bracteis 2 latioribus plerisque angustioribus, non cornutis hirtellis; bracteolis lineari-lanceolatis hirtellis; perigonii segmentis 4 aequalibus, 0.5 mm. longis linearibus; staminodiis minutis; achenio 1.5–1.8 mm. longo, oblongo apice acuto, 4-costato.

BRITISH NEW GUINEA: Murray Pass, Wharton Range, alt. 2840 m., *Brass 4609* (TYPE), June-Sept. 1933 (single colony seen; epiphytic small shrub; leaves pale).

In Winkler's key to the species, Bot. Jahrb. 57: 521–523. 1922, this species appears closest to *E. peperomioides*, but it is readily distinguished from that species by the smaller size of the leaves and their dentation as well as by the lack of horns on the bracts of the inflorescence. Its leaves are about the size of those of *E. mongiense* Lauterb.; however, in the latter species the whole margin of the leaf is rounded-serrate, whereas in *E. whartonense* the narrower side has only one dentation, on the broader side are 1–3 (mostly 2) teeth towards the apex; the pubescence along the nerves of the lower surface often projects like minute tufts beyond the tip of these teeth, causing them to appear sharper than they really are.

Elatostema perpusillum sp. nov.

Herba parva epiphytica ramosa; caulibus gracilibus in speciminibus vix 1.5 mm. diametro sursum ad 0.4 mm. diametro, ramulis parce pilosis vel glabris, internodiis 1–5(–8) mm. longis; foliis subsessilibus (petiolo plerumque vix 0.5 mm. longo, interdum fere 1 mm. longo), distichis in

ambitu et magnitudine valde diversis, 5 × 3 mm., 11 × 3 mm., 10 × 4 mm., 10 × 6 mm., 14 × 5 mm., 21 × 4 mm., 19 × 7 mm., oblongis vel obovatis fere aequilateralibus, basi parum obliquis, cuneatis vel latere latiore fere obtusis, apice obtusis vel obtusiusculis latere latiore 1–4-dentatis, latere angustiore 1–3-dentatis, supra glabris subtus minute et consperse fusco-granulosis costa pilosulis, penninerviis vel basi trinerviis et superne nervis lateralibus 1–3 in dentes terminantibus; stipulis lanceolatis vix 1.5 mm. longis cito caducis; inflorescentiis ♂: singulis axillaribus 1–3-floris breviter pedunculatis, pedunculo usque 1.5 mm. longo; bracteis 2 exterioribus circiter 2 mm. longis obtusis carinatis 0.5 mm. corniculatis glabris vel costa parce pilosulis, interruptis lineolis brunneis ornatis, interioribus similibus sed angustioribus; floribus ♂: perigonii segmentis 4 vel 5, obovatis 2 mm. longis sub apice 0.5 mm. corniculatis; inflorescentiis ♀: circiter 2.5 mm. longis latisque, sessilibus vel subsessilibus paucifloris, bracteis et bracteolis rigide pilosis, pilis usque 2 mm. longis; floribus ♀: perigonii segmentis 4 linearibus longe pilosis consperse brunneo-granulosis, juvenilibus ovario longioribus, maturis longitudine achenii fere aequantibus; staminodiis in fructu manifestis; achenio ovoideo 1.2 mm. longo compresso minute ruguloso.

NETHERLANDS NEW GUINEA: climbing on undergrowth of rainforest gullies, common, 15 km. SW. of Bernhard Camp, Idenburg River, alt. 1800 m., *Brass 12029* (TYPE), Jan. 1939.

Out of four staminate inflorescences which I examined, I found only one in which the perianth parts were four; in all others the perianth was 5-parted. It is a curious feature that the staminate inflorescence is practically glabrous (occasionally with a few scattered hairs on bracts and bracteoles), but the pistillate inflorescence is clothed with relatively long hairs on bracts, bracteoles, and perianth, in fact the pistillate inflorescence is very difficult to dissect on account of the long hairs being tangled in the pressed specimen. The pistillate flower is very short-pedicelled in this species. I had thought at first to place this specimen in *E. hymenophyllum* Hub. Winkl., but the only cystoliths apparent are along the main branches; very few stipules remain on the collection, and the staminate flowers are on much shorter pedicels than those in *E. hymenophyllum*. It should also be compared with *E. fragile* Hub. Winkl. The latter has simple canaliculate stems (when dry) and persistent stipules, as well as incised-serrate leaves; on the other hand, in *E. perpusillum* the stems are subterete (canaliculate only at the apex), the stipules caducous, and the leaves serrate-dentate, not incised. *Elatostema doormanianum* and *E. perpusillum* have a wide variation in the size of the leaves, but in the former the base is described as subauriculate on one side, in the latter both sides are cuneate at the base, or one side is at most somewhat obtuse.

Elatostema tridens sp. nov.

Herba parva repens ad apicem breviter adscendens parce ramosa; caulibus tenuibus pilosulis; foliis distichis subsessilibus oblongis, 7–13 cm.

longis 3–5 cm. latis, valde inaequilateralibus, apice inaequaliter grosse tridentatis, dente medio longiore, latere latiore dente minore interdum auctis, basi valde obliquis, latere angustiore subacuminatis, latere latiore anguste auriculato-semicordatis, auriculo petiolum 1–2 mm. longum tegente, supra prope marginem sparsim pilosulis ceterum glabris, subtus costa et nervis et interdum margine sparsim pilosulis; basi trinerviis, in latere latiore sursum nervo basali cum 1–2 lateralibus conjuncto, cystolithis supra conspersis subtus praecipue in nervis conspersis; stipulis vix 1 mm. longis hyalinis caducis; dioicis; inflorescentiis ♂: singulis axillaribus subsessilibus; bracteis 2 exterioribus late ovatis circiter 4 mm. longis sub apice haud 1 mm. corniculatis, interioribus 6 circiter 3 mm. longis corniculatis, bracteolis corniculatis apice pilis paucis ornatis; floribus 5 breviter pedicellatis ante anthesin; perigonii segmentis 4 subaequalibus sub apice pilis paucis ornatis et corniculatis; inflorescentiis ♀: singulis sessilibus; bracteis 2 exterioribus ovatis 3 mm. longis, concavis apicem versus subcarinatis et ciliatis sub apice corniculatis, interioribus angustioribus ciliatis et corniculatis, bracteolis ciliatis; floribus ♀ immaturis 2 mm. pedicellatis; perigonii segmentis 3 inaequalibus; ovario ellipsoideo.

NETHERLANDS NEW GUINEA: sandy edges of a stream in forest, 9 km. NE. of Lake Habbema, alt. 2700 m., *Brass 10770*, Oct. 1938; here and there on wet shady banks of a stream, Bele River, 18 km. NE. of Lake Habbema, alt. 2200 m., *Brass 11310* (TYPE), Nov. 1938.

Unfortunately I cannot suggest an alliance for this species.

SUBGEN. PELLIONIA

Elatostema angulare Hubert Winkler in Bot. Jahrb. 57: 549, *fig. 8*. 1922. — Schröter & Winkler in Rep. Spec. Nov. Beih. 83(2): 46. 1936.

NETHERLANDS NEW GUINEA: in flood-plain rain-forest, alt. 850 m., *Brass 13378, 13499*, March 1939 (low epiphyte; stem fleshy, unbranched, 60–80 cm. long).

These two staminate specimens suit the description of this species. Unfortunately there are no duplicates, and the pistillate plants are still unknown.

Elatostema sinuatum (Bl.) Hasskarl, Catalog. Pl. Bogor. 79. 1844, ampl. Hilde Schröter in Rep. Spec. Nov. Beih. 83(2): 29, 30. 1936.

BRITISH NEW GUINEA: riverine rain-forest, Palmer River, 2 miles below Black River Junction, alt. 100 m., *Brass 6906*, June 1936 (epiphytic close to the ground; stems reddish, 60–80 cm. long, one, two, or more produced from small fleshy stock 3–5 cm. diameter; petioles, midrib and nerves on the lower surface of the leaves reddish).

Although this specimen does not agree too well in foliar characters, I cannot seem to place it elsewhere than with this species. The leaves are 7.5–13 cm. long (including acumen 2 cm. long), 1.5–3.5 cm. wide, lanceolate or oblong-lanceolate, with cuneate base of lower leaves short and

broad, the upper half of the margin denticulate, entire below. The small leaves are lanceolate or ovate, 1–2 cm. long.

Elatostema sinuatum var. **pedunculatum** (Hub. Winkler) Hilde Schröter in Rep. Spec. Nov. Beih. 83(2): 32. 1936.

NORTHEAST NEW GUINEA: Sepik River near August River, *Womersley, NGF 3800*, Sept. 1949 (epiphyte near base of trees; branches long and spreading).

NETHERLANDS NEW GUINEA: common in rain-forest of river flood plain, 4 km. SW. of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13689*, Mar. 1939 (small fleshy unbranched semi-epiphyte; stems, petioles, and peduncles red); rain-forest of moist hollows, Bernhard Camp, Idenburg River, alt. 60 m., *Brass 13771* (♀), *13771A* (♂), April 1939 (common low epiphyte; several fleshy spreading branches 1–1.5 m. long; inflorescence red).

These collections appear to agree fairly well with the description cited above.

Elatostema pauperatum Hubert Winkler in Bot. Jahrb. 57: 551. 1922. — Schröter & Winkler in Rep. Spec. Nov. Beih. 83(2): 45. 1936.

NETHERLANDS NEW GUINEA: frequent in rain-forest ravines, 6 km. SW. of Bernhard Camp, Idenburg River, alt. 1200 m., *Brass 12936*, Feb. 1939 (ascending herb ±60 cm.); epiphytic in rain-forest, Sennen, 40 km. inland from Nabire, alt. 300 m., *Kanehira & Hatusima 12478*, March 1940.

In size of leaves and small inflorescences these two collections agree with the description of *E. pauperatum* Hub. Winkl.

Aff. **Elatostema cauliflorum** Hubert Winkler in Bot. Jahrb. 57: 556. 1922.

NETHERLANDS NEW GUINEA: in high rain-forest, Papaya, 20 km. inland from Nabire, alt. 100 m., *Kanehira & Hatusima 11715*, Feb. 1940; Patema, 40 km. inland from Nabire, alt. 300 m., *Kanehira & Hatusima 11964*, Feb. 1940.

I have been at a loss to place these two collections with any degree of certainty. However, after examining the plate of *E. lamii* Hub. Winkl., which has been accepted as a synonym of *E. cauliflorum* by Schröter & Winkler, I am satisfied that the plants cited here are closely allied. The leaves are smaller, without a definitely marked acumen, and the flowers are smaller than those described for this species.

Elatostema inconstans sp. nov.

Planta scandens ut videtur dioica, parce ramosa, glabra partibus juvenilibus squamulis brunneis minutis parce conspersa; caulibus adscendentibus superne sat tenuibus subsulcatis inferne sublignescentibus subteretibus; foliis pusillis non visis; foliis normalibus chartaceis subsessilibus (petiolo vix 2 mm. longo), linearibus vel lineari-oblongis vel lanceolato-oblongis vel anguste obovatis, superioribus 5 × 0.4–0.8 cm., 4.5 × 1.3 cm., 6.5 × 2 cm., inferioribus 0.5 × 0.3 cm., 2.5 × 0.4 cm., 2 × 1 cm., parum inaequilateralibus, apice obtusiusculis vel subacuminatis, basi parum obliquis cuneatis vel obtusis, supra trientem vel dimidium serrato-dentatis,

utrinque cystolithis copiosis, pinnatinerviis vel in foliis angustioribus fere semipenninerviis, nervis lateralibus utrinsecus 5–9 arcuatim anastomosantibus; stipulis deciduis 7–9 mm. longis, lineari-lanceolatis, hyalinis; inflorescentiis ♂: non visis; inflorescentiis ♀: axillaribus sessilibus vel subsessilibus, bracteis et bracteolis stipulis similibus sed minoribus usque 2 mm. longis; floribus fasciculatis, 5-meris pedicellatis, pedicello usque fere 3 mm. longo, perigonii segmentis ad basin liberis ovatis 2 mm. longis valde carinatis sub apice longe cornutis, cornu usque 3 mm. longo; achenio immaturo 1.5 mm. longo ovoideo minute verruculoso.

BRITISH NEW GUINEA: on woody undergrowth of lower ridge forests, common, Palmer River, 2 miles below Black River junction, alt. 100 m., *Brass 7154* (TYPE), July 1936 (climbing to 1 m.).

Possibly this collection is near *E. cauliflorum* or *E. paramelanum*, both of which are characterized by longish acuminate leaves; the leaves of *E. inconstans* are indeed variable but never longish acuminate; the flowers are closely clustered; the horns of the perianth-segments are as long as or longer than the main body of the segments.

Elatostema grammicum sp. nov.

Herbacea glaberrima; caulibus radicibus scandentibus apicem versus parce ramosis subteretibus; foliis pusillis non visis, foliis normalibus chartaceis, 5–11.3 cm. longis 1.7–4.3 cm. latis, lanceolatis vel elliptico-lanceolatis utrinque angustatis, apice breviter et obtusissime acuminatis, basi cuneatis, utrinque cystolithis oculo nudo manifestis et copiosis, costa supra canaliculata subtus prominula, nervis lateralibus utrinsecus 4 vel 5 subobscuris arcuatim conjunctis; petiolo 1.3–3.3 cm. longo; stipulis 1.5–2 mm. longis ovatis submembranaceis caducis; inflorescentiis ♂: non visis; inflorescentiis ♀: saepissime e caule scandente defoliato ortis, usque 2 cm. longis latisque laxe cymosis, squamulis minutis brunneis conspersis, pedunculo usque 1 cm. longo; bracteolis graciliter lanceolatis circiter 0.5 mm. longis; floribus pedicellatis, pedicello 0.5–2 mm. longo, 5-meris, perigonii segmentis ad basin liberis, oblongo-lanceolatis 2.5 mm. longis, apice cornutis, cornu 1–1.5(–2) mm. longo, staminodiis in flore minimis, in fructu obviis; achenio fere 2 mm. longo ovoideo compresso subreticulate brunneo-lineato.

BRITISH NEW GUINEA: Fly River, 528 mile Camp, alt. 80 m., *Brass 6791* (TYPE), May 1936 (slender root-climber 1 m. long, attached to base of a tree; leaves glabrous, fleshy, the nerves very dark above; inflorescence green).

According to the description of *E. truncicola* Hub. Winkl., it must be the closest relative of this species; however, the Brass collection differs in having much smaller stipules, an abundance of linear cystoliths on both surfaces of the leaves, pedunculate and loosely cymose inflorescences.

Elatostema mafuluense sp. nov.

Suffruticosa, glabra, ramosa; specimine uno ramo vel ramulo consistente basi 4 mm. apice 1 mm. diametro sicco angulato; foliis normalibus petio-

latis, petiolo 1–2 cm. longo, oblongis 7–13 cm. longis, 2–4 cm. latis, apice abrupte acuminatis, acumine 0.7–1.5 cm. longo acuto, basi cuneatis paulo obliquis, integris vel subintegris, penninerviis, nervis lateralibus utrinsecus 7–9 utrinque manifestis obliquo-adscendentibus, cystolithis numerosis tenuiter linearibus; stipulis lanceolatis 1.1 cm. longis, caducis; inflorescentiis ♂ : non visis; inflorescentiis ♀ : circiter 10 mm. diametro, pedunculatis, pedunculo 3 mm. longo, axillaribus; floribus 2 mm. pedicellatis, perigonii segmentis 2–2.5 mm. longis sub apice carinato-cornutis cornu 1–1.5 mm. longo, staminodiis manifestis, achenio 2 mm. longo, 1.2 mm. lato, ovoideo lateraliter compresso, stramineo tuberculato.

BRITISH NEW GUINEA: amongst herbaceous growth in gully of forest, Mafulu, alt. 1200 m., *Brass 5149* (TYPE), Sept.-Nov. 1933 (low somewhat fleshy shrub with shining thick leaves; branches, petioles and inflorescence reddish).

I am at a loss to suggest a close relative of this species. Tracing it through the key in Rep. Sp. Nov. Beih. 83(2): 2–8. 1936, it seems nearest the description of *E. truncicola* Hub. Winkl., from which one gathers that the main part of the perianth is 2–2.5 mm. long, and by referring to the key finds the horns are 2 mm. long, that is in all 4–4.5 mm. long, which is approximately the size of the fruiting calyx in the species above described. However, *E. truncicola* is a climber with rooting stems, reddish fruit, and leaves resembling those of *Procris;* none of these characters appear to suit *E. mafuluense.*

Elatostema curvitepalum sp. nov.

Planta herbacea vel suffruticulosa epiphytica glabra; caulibus breviter scandentibus simplicibus, internodiis 1–1.5 cm. longis; foliis chartaceis subsessilibus (petiolo haud 1 mm. longo) obovato-oblongis, superioribus 9.5–16 cm. longis, 2.8–4 cm. latis, infimis 2 cm. longis, 0.8 cm. latis, longe acuminatis, acumine 1.5–3.5 cm. longo, basi paulo obliquis cuneatis vel obtusiusculis, margine (fere integris) obsolete denticulatis vel undulatis, cystolithis linearibus supra parcissime conspersis subtus praecipue in costa et nervis ornatis, nervis lateralibus utrinsecus costa 8–10 utrinque manifestis; stipulis hyalinis lineari-lanceolatis 6–12 mm. longis, basi 1.5–2 mm. latis; inflorescentiis ♂ : non visis; inflorescentiis ♀ : axillaribus, laxe capituliformibus vel compacte cymosis, 1–1.5 cm. diametro, subsessilibus; floribus pedicellatis, pedicellis usque 2.5 mm. longis; perigonii segmentis obovato-oblongis circiter 1.5 mm. longis cucullatis margine brunneo-glanduloso-adspersis; staminodiis brunneis; achenio ovoideo lateraliter compresso, verruculoso, 1 mm. longo.

BRITISH NEW GUINEA: epiphytic near ground on riverbank trees or on undergrowth bushes of lower ridge forests, Palmer River, 2 miles below junction Black River, alt. 100 m., *Brass 6871* (TYPE), *7155*, June, July 1936 (small epiphyte of shortly climbing habit).

In addition to the above collections which are pistillate, there is a staminate collection which may belong here: *Brass 6722*, Fly River, 528 mile Camp, alt. 80 m., a small plant climbing to 2 m. on substage tree,

with branches and leaves somewhat fleshy, and very small fleshy white flowers in short panicles below the leaves. Although superficially the leaves look like those of the pistillate collections, they are larger and under a lens appear abundantly punctate on the upper surface; the lower surface has a brownish color, whereas the others are grayish. Since they do not come from the same locality, with the paucity of material for comparison it seems best only to call attention to this collection here.

Elatostema eludens sp. nov.

Planta circiter 25–35 cm. alta, glabra; caulibus in sicco sulcatis vel angulatis, internodiis inferioribus usque 4 cm. apicem versus 1 cm. longis; foliis normalibus breviter petiolatis, petiolo 3–11 mm. longo, tenuiter chartaceis, oblongo-lanceolatis, 13–17 cm. longis, 3–6 cm. latis (inferioribus 6.5 × 2 cm.), basi obliquis, utrinque cuneato-obtusis, apice longe acuminatis, acumine 2–4 cm. longo, subintegro vel inferiore dentato, margine superiore ½ leviter crenato-dentatis vel dentato-serratis, supra copiose punctatis subtus pallidioribus, penninerviis, nervis lateralibus utrinsecus 8–11 oblique adscendentibus prominulis, secundariis et rete utrinque manifestis; inflorescentiis ♂: non visis; inflorescentiis ♀: axillaribus, sessilibus 6–8 mm. diametro; floribus usque circiter 2 mm. pedicellatis, perigonii segmentis 5, lineari-oblongis carinato-cucullatis circiter 1.5 mm. longis, (in fructu) staminodiis expansis fere 1.5 mm. longis, achenio ovoideo lateraliter compresso 1 mm. longo 0.5 mm. lato, brunnei-lineolato.

NETHERLANDS NEW GUINEA: abundant in the dense herbaceous undergrowth of rain-forest on alluvial flats, Bernhard Camp, Idenburg River, alt. 55 m., *Brass 13816* (TYPE), April 1939.

The flowers of this species are very much like those of *E. curvitepalum* described above, but smaller. The leaves resemble those of *E. Weinlandii*. In the latter, however, the perianth is finer and shorter than in *E. eludens*.

SUBGEN. ELATOSTEMATOIDES

Elatostema Beccarii Hilde Schröter in Rep. Spec. Nov. Beih. 83(2): 125, *pl. 35*. 1936.

BRITISH NEW GUINEA: gregarious herb abundant below flood-level on slopes of high forested promontories along river, Fly River, 528 mile Camp, alt. 80 m., *Brass 6726*, May 1936; on inundated slopes of rocky promontories along river, Palmer River, 1 mile above Black River junction, *Brass 6959, 6962, 6963*, June 1936 (the chief constituents of a dense herbaceous inundation-community on the steep sides of a forest-clad promontory, massed in pure stand on limestone outcrop frequently covered by river); Palmer River, 2 miles below Black River junction, alt. 100 m., *Brass 7107*, June 1936.

All these collections agree with the habit of *E. Beccarii* Schröter as shown in the plate cited above. Schröter mentioned in the discussion that the flowers in the type are badly preserved. Here the inflorescences (up to 3.5 cm. broad and 2 cm. long) are for the most part not sessile and capituliform but pedunculate (peduncles up to 5 mm. long) and cymose.

The perianth segments are elliptic-oblong or oblong rather than lanceolate or linear-lanceolate, and about 1 mm. long; the fruit is slightly longer.

Elatostema Weinlandii K. Schumann in Schum. & Lauterb. Fl. Deutsch. Schutzgeb. Südsee Nachtr. 254. 1905. — Hubert Winkler in Bot. Jahrb. 57: 553. 1922.

Elatostema Weinlandii var. *eu-Weinlandii* Hilde Schröter in Schröter & Winkler in Rep. Sp. Nov. Beih. 83(2): 115. 1936.

NORTHEAST NEW GUINEA: Sattelberg, alt. about 1000 m., *Clemens 3110*, May 1936; Boana, alt. about 900 m., *Clemens 8397*, July 1938 (plant 4–5 ft. high); vicinity of Kajabit Mission, alt. 240–600 m., *Clemens 10592*, Aug. 1939; jungle ravine, 4 miles south of Langemak Bay (vicinity of Finschhafen), alt. 100 m., *Sawyer 103*, Apr. 1945.

BRITISH NEW GUINEA: plentiful in flood-plain forest, Palmer River, 2 miles below Black River junction, alt. 100 m., *Brass 7330*, July 1936 (usually gregarious in stands 80–100 cm. high).

Elatostema Weinlandii var. **yulense** (Hallier f.) Hubert Winkler in Bot. Jahrb. 57: 555. 1922. — Schröter & Winkler in Rep. Sp. Nov. Beih. 83(2): 120. 1936.

BRITISH NEW GUINEA: abundant in semi-shade on promontories along river, Fly River, 528 mile Camp, alt. 80 m., *Brass 6778*, May 1936 (woody herb 50–60 cm. high; petioles red); gregarious in forest undergrowth on high promontories along river, Fly River, 528 mile Camp, alt. 80 m., *Brass 6776*, May 1936 (scrambling shrub attaining 2 m., inflorescence red, usually lateral).

The first cited collection (*Brass 6778*) is pubescent along the stems and the veins of the lower surface of the leaves. The leaves are 11–20 cm. long, 3–5 cm. broad. This is very like the description of var. *yulense*. The other specimen has much broader leaves, 17–19 cm. long, 6–7.5 cm. broad. The leaves are glabrous except at the very base; the petioles and the inflorescences are pubescent.

Elatostema Weinlandii var. **Kochii** (Valeton) Hubert Winkler in Bot. Jahrb. 57: 554. 1922. — Schröter & Winkler in Rep. Sp. Nov. Beih. 83(2): 119, *pl. 31*. 1936.

NETHERLANDS NEW GUINEA: common in rain-forest of river flats, 4 km. SW. of Bernhard Camp, Idenburg River, alt. 850 m., *Brass 13688*, March 1939 (semi-epiphytic; stems to 1 m. long, not branched); abundant in rain-forest on lower slopes, Bernhard Camp, Idenburg River, alt. 60 m., *Brass 13798*, April 1939 (ascending and branched, about 60 cm. high); rain-forest of moist hollows, Bernhard Camp, Idenburg River, alt. 60 m., *Brass 13771B*, *13771C*, April 1939 (common low epiphyte; several fleshy spreading branches 1–1.5 m. long).

Elatostema Weinlandii var. **inamoenum** (Hub. Winkler) Hilde Schröter in Schröter & Winkler in Rep. Sp. Nov. Beih. 83(2): 118. 1936.

NORTHEAST NEW GUINEA: jungle ravine, 4 miles south of Langemak Bay (vicinity of Finschhafen), alt. about 100 m., *Sawyer 101*, April 1945 (plants 5–10 inches high).

Cf. **Elatostema rigidum** var. **laxum** (Elmer) Hilde Schröter in Schröter & Winkler in Rep. Sp. Nov. Beih. 83(2): 111. 1936.

BRITISH NEW GUINEA: forest, Koitaki, alt. about 450 m., *Carr 12018*, Apr. 1935 (herb about 3 ft. tall; flowers whitish).

The inflorescence on the specimen at hand is too immature to show details. The leaves are most like those of *E. rigidum* var. *laxum* (Elm.) H. Schröter, but in some of the Philippine specimens the dentation is coarser. Probably *E. kietanum* Rech. is closely related, but the leaves of Rechinger's species are not so definitely serrate-dentate.

Arnold Arboretum,
Harvard University.

NOTES ON THE FLORA OF CHINA, I

SHIU-YING HU

With one plate

THE MAJORITY OF THE NOVELTIES described in this paper are deposited in the herbarium of the Arnold Arboretum (A). Some are in the Gray Herbarium (G), and a few are in the New York Botanical Garden (NY), the United States National Herbarium (US), the British Museum of Natural History, England (B), or at Lingnan University, China (LU).

Fokienia hodginsii (Dunn) Henry & Thomas in Gard. Chron. ser. III. **49**: 67, *fig. 22–23*. 1911; **59**: 72, *fig. 30*. 1916. — Clinton-Baker, Ill. Conif. **3**: 85, *pl.* 1913. — Merr. in Philip. Jour. Sci. **21**: 492, *fig. 1 b*. 1922. — Pilger in Nat. Pflanzenfam. ed. *2*, **13**: 391. 1926. — Hu in Contrib. Biol. Lab. Sci. Soc. China **2**(5): 10. 1926. — Chun in Ic. Pl. Sin. 1: *pl. 13*. 1927. — Hickel in Lecomte, Fl. Gén. Indo-chine **5**: 1082, *fig. 127, 3–7*. 1931. — Brillet in Bull. Econ. Indo-chine n. ser. **33 B**: 916 B. pl. [1–5]. 1930. — Chun in Sunyats. **1**: 211. 1934. — Lee, For. Bot. China 92, *pl. 39*. 1935. — Metcalf, Fl. Fuk. 30. 1942. — Chen, Ill. Man. Chin. Trees Shrubs 57, *fig. 44*. 1937. — Dall. & Jacks., Handb. Conif. 299. 1923; 3rd ed. 287. 1948.

Cupressus hodginsii Dunn in Jour. Linn. Soc. **38**: 367. 1908. — Henry in Tree Gr. Br. & Irel. **5**: 1150. 1910.

Fokienia kawaii Hayata in Tokyo Bot. Mag. **31**: 116. *fig.* [*1*]. *1–2*. 1917. — Wilson in Jour. Arnold Arb. **7**: 62. 1926.

Fokienia maclurei Merr. in Philip. Jour. Sci. **21**: 492, *fig. 1 a*. 1922. — Groff in Lingnan Sci. Jour. **9**: 294. 1930.

Flores masculi strobilis terminalibus, solitariis, raro 2 vel 3 fasciculatis, oblongis, 1.5–2 mm. longis, 1–1.2 mm. diametro, squamis 8 vel 10, oppositibus decussatisque, subcordatis subpeltatibusque, 1 mm. diametro, antheris 3 (Plate I, 1–3).

CHINA: Chekiang: Ching-yuan, *R. C. Ching 2345* (A), *2361* (A), same locality, *Y. L. Keng 350* (A). Fukien: Clinton-Baker in 1911 (A); Yen-ping, Bu-ong, *Dunn* ex Hongkong Herb. no. *3505* (A, ISOTYPE), *H. H. Chung 3410* (A, TOPOTYPE); Foochow, *Hodgins* ex Hongkong Herb. no. *7289* (A) and *8210* (A). Kwangtung: Tai-yong, *J. L. Gressitt 1740* (A); Taai-yang shan, *F. A. Maclure 6572* (ISOTYPE of *F. maclurei*, A). Kweichow: Ping-chow, *Y. Tsiang 7135* (A), Ta-ting, *Y. Tsiang 8867* (A). Yunnan: Tsing-pian, *H. T. Tsai 52527* (A).

INDO-CHINA: Tonkin: Chapa, *B. Hayata* in 1917 (A). Annam: Nhatrong, *M. Poilane 3462* (A), *3539* (A), *4397* (A), *6527* (basis for the description of the male flower, A).

Forty-six years have elapsed since Dunn first discovered *Cupressus hodginsii*, the type species of the genus *Fokienia*. During this half-

century the male flowers of this monotypic Asiatic genus have been unknown to botanists. Among the literature cited above, with one exception, there is no mention of the nature of the male flower of the genus. Brillet in 1930 recorded his observation of the male cones. Being a forester, his chief interest was focused on the color, size, and the time of anthesis of the strobiles. The description of the male flower of *Fokienia* is recorded above.

Regarding the relative positions of the male and the female strobiles of *Fokienia* in the branching system, I agree with Brillet's statement which reads, "Elles [male strobiles] sont situées à l'extrémité des petits rameaux latéreaux secondaires qui s'étalent au sommet du rameau principal, tandis que les fleurs femelles, beaucoup moins nombreuses, sont situées à la base de ce même rameau principal." In this respect *Fokienia* resembles certain species of *Chamaecyparis*. The ultimate branchlets which bear the female flowers are very short. Consequently the "mature cones" are on very "short scaly stalks (about 1/8 inch long)," as originally described by Henry and Thomas. This point has been overlooked, so far as I know, in all Chinese illustrative botanical publications. In them the mature cones have been placed on "stalks" longer than the diameter of the fruit. This is never the case in reality. Moreover, in these illustrations the seed is shown to have an oblique terminal wing. This is a misrepresentation of the seed character of the genus. Among all the specimens I have examined, including the isotypes, the seed has been bilaterally winged, as first described by Dunn: "Semina . . . bialata, ala majore ovata 5 mm. longa, minore angusta apice paullo producta." Here it seems fitting to reaffirm that the wings of the seed of *Fokienia* are lateral and unequal, and that they never meet at the micropyle end. Among the specimens that I have examined there is considerable variation in the size of the seed, in the shape and size of the wings, and in their angle of attachment (Plate I, 4–11). It appears that the age of the cone, the position and shape of the subtending scales, and the relative point of attachment of the ovule are the controlling factors for such variation. Since variation may occur among different seeds of the same cone, it seems to be logical to designate them all as typical of the monotypic genus *Fokienia*.

Boenninghausenia schizocarpa sp. nov.

Suffrutex 50 cm..altus, ramulis novellis villosis, glabrescentibus; foliis ternato-pinnatis, foliolis 20–27, petiolulatis, foliolis terminalibus obovato-cuneatis, 2–3 cm. longis, 1.5–2 cm. latis, foliolis lateralibus oblongis vel raro obovato-oblongis, 1–2.5 cm. longis, 0.5–1.5 cm. latis; petiolis 5–6.5 cm. longis, glabrescentibus, rhachibus secondariis 1.5–3 cm. longis; inflorescentiis paniculatis, bracteis foliaceis, pedicellis gracilibus, filiformibus, 6–10 mm. longis, glabris; floribus 4-meris; calycibus patelliformibus, 2 mm. diametro, lobis 4, ovatis; petalis oblongis, albis, 6 mm. longis, 3 mm. latis, integerrimis; disco campanulato, apice integro, glanduloso; stamini-

bus 8, basi disci insertis, antheris oblongis, filamentis petalis subaequilongis; ovario longistipitato, stipitibus pedicellis aequilongis, carpellis separatis, stylis lateralibus; folliculis 4, obliquis, 3 mm. longis, seminibus 4–6, 1.5 mm. longis, 0.8 mm. diametro, rugosis et tuberculatis, tuberculis confertis.

CHINA: Yunnan: Chung-tien, *K. M. Feng 2056* (A), *2764* (A), *3269* (A); between Taku and Chungtien, *C. Schneider 3117* (TYPE, A); Mien-ning, Po-shang, *T. T. Yü 17982* (A).

INDIA: *K. Biswas* in 1937 (G).

This species can easily be distinguished by its elongated stipe which splits at the apical end, and by its ovary with the four carpels separated at the base.

Boenninghausenia sessilicarpa Lévl. in Fedde Repert. **12:** 282. 1913. — Hand.-Mzt., Symb. Sin. **7:** 628. 1933.

Boenninghausenia albiflora (Hook. f.) Meisner var. *brevipes* Franch. in Bull. Soc. Bot. France **33:** 450. 1886; Pl. Delavay. 123. 1889. — Rehder in Jour. Arnold Arb. **14:** 225. 1933; **18:** 210. 1937.

Boenninghausenia brevipes (Franch.) Lévl., Cat. Pl. Yun-Nan 249. 1917.

Léveillé, in 1913, published *B. sessilicarpa* as a *nomen subnudum*, based on a specimen collected by E. E. Maire from Tong-Tchouan, Yunnan. Four years later, for no obvious reason, he adopted Franchet's varietal epithet, raised it to specific rank, and reduced his earlier binomial to synonymy. Rehder, after examining ten specimens from Yunnan, including Léveillé's type, concluded, "This variety is well distinguished from the type [*B. albiflora* (Hook. f.) Meisner], by the nearly sessile carpels, but as there are no concomitant characters except that the leaves are rarely thrice pinnate and the leaflets are smaller, it can hardly be considered specifically distinct." He continued, "It seems, however, geographically well separated . . ." After examining the material Rehder cited and many more additional collections from Yunnan and Szechwan, I found that besides the sessile carpels and the well-marked geographical separation, the shrubby habit, the subglobose flower buds, the small calyx with rounded lobes, and the annular fleshy nectaries are all constant concomitant characters to set this species apart from the one with long-stipitate carpels, cylindric flowers buds, and tubular nectaries.

Léveillé validated this binomial with a description of one line, which reads, "Differt a *B. albiflora* foliis 3-plo minoribus et capsulis sessilibus vel subsessilibus." Twenty years later, in 1933, Handel-Mazzetti supplied us with some information regarding the shape of the flower which goes, "sternförmig offene, nicht glockenförmige Blüte." Besides these two accounts, our knowledge about the plant is wanting in botanical literature. The following description is thus supplied to fill the gap.

Low shrub up to 0.5 m. high, the stem profusely branched, the eight-years' growth 5 mm. in diameter, the bark gray, smooth, the lenticels few, inconspicuous, the current year's growth very slender, largely herbaceous, terminating in a paniculate inflorescence. Leaves ternately compound,

with 7–15, usually 9, punctate and entire leaflets, the terminal one obovate or subrhomboid, or rarely spatulate, 4–12 mm. long, 3–8 mm. wide, the lateral ones oblong, smaller than the terminal ones. Inflorescences glabrous, individual flowers subtended by a linear-oblanceolate, often leafy bracteole, the pedicels 6–14 mm. long, the flower buds subglobose before anthesis; calyx patelliform, 1 mm. across, shallowly 4-lobed, the lobes round; corolla star-like at anthesis, 2.5 mm. in diameter, glandular, the petals 4, free, suborbicular, nectary annular; stamens 8, attached to the base outside the nectary, the filaments unequal, longer or shorter than the petals, the anthers subglobose, basifixed; ovary sessile or subsessile, the carpels 4, separated at the base, the style club-shaped, laterally attached, the stigma more or less capitate, the ovules 2–4 in each cell. Fruit pseudocapsular, the pericarp dehiscent by an apical slit on the dorsal suture. Mature seeds 2 or 3 in each cell, ovoid, tubercular, and ridged.

CHINA: Yunnan: W. Likiang, La-schi-ba, *R. C. Ching 21082* (A); *21793* (A); Li-kiang Snow Range, *R. C. Ching 30276* (A); Kun-ming, Hsi-shan, *K. M. Feng 104* (A); Haba, Yangtze bank, *K. M. Feng 1289;* Lidjiang, Yü-lung-schan, *Handel-Mazzetti 3925* (A); Kun-ming, Miao-kao-szu, Ta-p'u-chi, *S. K. Lau 29403* (A); Tong-chouan, *E. E. Maire* in July 1912 (SYNTYPE, photo and fragment, A), in Sept. 1912 (SYNTYPE, fruit, fragment, A); Yunnan-fu, *C. Schneider 135* (A); Likiang, *C. Schneider 1764* (A, G), *1780* (A, G), *2822* (A); Kun-ming, Hsi-shan, *O. Schoch 295* (A); Likiang, *C. W. Wang 70591* (A), *70705* (A), *71339* (A); Li-chiang Snow Range, *T. T. Yü 15326* (A). Sikang: Tsa-wa-rung, *C. W. Wang 65311* (A); without precise locality, *Forrest 4758* (G). Szechuan: Muli, *J. F. Rock 18326* (G); Muli, Wa-chin, *T. T. Yü 14731* (A); Huei-li, *T. T. Yü 1622* (G).

INDIA: Khazya, *Gardea 7* (G).

Sauropus changiana sp. nov.

Frutex humilissimus (Plate I, 12), 10–20 cm. altus, ramis rugosis, subteretibus, glanduloso-pubescentibus, 2–3 mm. diametro, striatis, internodiis 1–3 mm. longis; foliis subcoriaceis, olivaceis, utrinque subconcoloribus, glabris, basim prope glanduloso-pubescentibus, obovato-oblongis, 6–7 cm. longis, 2.5–3 cm. latis, apice rotundatis, retusis mucronatisque, basi cuneatis, costa supra et subtus elevata, nervis lateralibus utrinque 7, prominentibus; margine integerrimo, incrassato; petiolo 2–3 mm. longo, glanduloso-pubescente; stipulis cordatis, acuminatis, 5–7 mm. longis, 3 mm. latis, persistentibus; floribus monoeciis, in caulibus trienniis vel vetustioribus fasciculatis, bracteis numerosis, lanceolatis, 1–2 mm. longis (Plate I, 15); pedicellis florum ♂ 3–4 mm. longis, filiformibus, perianthi segmentis 6, crassis, inflexis stamina tegentibus, staminibus 3, filamentis brevissimis, in centro floris connatis (Plate I, 13), antheris peltatis, sessilibus, loculis extrorsum dehiscentibus; pedicellis florum ♀ 2 mm. longis, perianthi segmentis 6, ovatis, 2 mm. diametro, acutis, ovario subgloboso, stylis 3, 2-fidis, ramis incurvatis (Plate I, 14); fructibus non visis.

CHINA: Kwangtung, *F. C. Chang,* in 1950 (TYPE, A).

In October, 1949, a crude drug under the vernacular name of "*lung-li-yeh*" (dragon-tongue-leaf) was sent to me by Dr. F. C. Chang, Head of the Chemistry Department, Lingnan University, Canton, China, for identification. I was told that in Canton the plant was collected and dried for medicinal purposes. A concoction made from the crude drug, in the market known as "*liang-ts'a*" (cold-tea), was sold for the preservation of health, especially in the warm seasons. It is generally believed there that the drink helps to prevent the occurrence of certain summer diseases. Dr. Chang and one of his graduate students, in their study on the antibiotic properties of the Chinese drugs, have extracted an antibiotic principle which has been proved to prohibit the growth of certain disease germs.

Because of the lack of flowers, fruit, or even leaves on the specimen involved, no conclusion even as to the family represented could be reached. The material was sent to Professor I. W. Bailey for anatomical study, with the hope that through the structure of the wood some clue might be found which would help us to work out the identity of the plant. The material, however, proved to be too poor for anatomical study to be of assistance in the problem. Dr. Chang then proceeded, on my suggestion, to search for some fertile material, and a year later he sent me a couple of flowering twigs. With the help of Dr. Lily M. Perry I discovered the genus to be *Sauropus*. This genus had been carefully studied by Dr. Croizat in the Arnold Arboretum some years ago. Here we have for comparison authentic material of all the published species from Asia, although some specimens are no more than fragments. Since my specimen could be identified with none of them, I am describing it as new and naming it in honor of Dr. Chang of Lingnan University.

The obovate-oblong leaf with the rounded obtuse apex, cuneate base, and entire margin, which is thickened by a fine reticulation of veinlets, suggests some relationship with *S. spathulaefolius* Beille. But the Indo-Chinese species has peduncled inflorescences, larger leaves up to 13 cm. long, 5 cm. wide, and internodes at least 1.5 cm. long.

Ilex latifrons Chun in Sunyats. **2:** 69. 1934.

Ilex kwangtungensis Merr. var. *pilosissima* Hand.-Mzt., Symb. Sin. **7:** 655. 1933.

Ilex latifrons Chun var. *pilosissima* (Hand.-Mzt.) Chun in Sunyats. **2:** 70. 1934.

Ilex kwangtungensis sensu S. Y. Hu in Jour. Arnold Arb. **30:** 303. 1949, in part.

Since my work on the genus *Ilex* in China was published, I have had an opportunity to examine the specimens of *S. P. Ko 51745*, an isoparatype of *Ilex latifrons* Chun, and *R. C. Ching 8265*, an isotype of *Ilex kwangtungensis* var. *pilosissima* Hand.-Mzt. Ko's material was collected from Wun-yi, Kwangtung, and Ching's was from Seh-feng-dar-shan, south of Nanning, Kwangsi. They both have entire coriaceous leaves which are pilose on both surfaces. This character, reinforced by the 5- or 6-pyrened

fruit, makes *Ilex latifrons* Chun a distinct species. It was a mistake to interpret it as *Ilex kwangtungensis* Merr., for this latter species has crenate leaves and 4-pyrened fruit. The large ovate or ovate-oblong or even oblong leaves up to 20 cm. long and 9.5 cm. wide, and the well-developed secondary axis of the infructescences, indicate close relationship with *Ilex maclurei* Merr., but the latter species is entirely glabrous. At first sight the texture of the leaves and the indumentum of the plant remind one of the Formosan species *Ilex lonicerifolia* Hayata. But the insular plant has smaller leaves and simple cymose infructescences.

Ko's Kwangtung specimen was collected from a young and vigorously growing tree 4 m. high. Its leaves are ovate, and their sizes vary between 9 × 5 and 20 × 10 cm. Ching's Kwangsi specimens were collected from trees reaching a height of 20–27 m., the leaves of which were ovate-oblong or oblong and varied from 10 × 3.5 to 18 × 6 cm. in size. In general the leaves are much narrower than those of the Kwangtung types. Nevertheless the texture, indumentum, and venation of all these specimens are identical. Moreover, the infructescences and fruits of both the Kwangtung and the Kwangsi plants are of like nature. It is very likely that as the plants reach maturity their leaves become narrower. Probably Ching's material represents a more normal form and size of the leaves of the species. Since there is so much variation in the size and shape of leaves in all species of *Ilex,* I see no reason for keeping the Kwangsi plant as a variety of the Kwangtung ones.

When Chun published this binomial he wrote, "This very distinct species must await flowers before it can be assigned to its proper section." However, I think that the solitary cymose infructescences in the axils of the leaves on the current year's growth, and the smooth pyrenes, each with a profound longitudinal dorsal canal, are sufficient to place it in its natural order, namely, the series Chinenses of the section Lioprinus.

Ilex subcrenata sp. nov. Sect. Paltoria.

Ilex oblata sensu Chun in Sunyats. **4**: 225. 1940, non Comber.

Frutex sempervirens, ramulis gracilibus, pubescentibus, hornotinis 0.5 mm. diametro; foliis coriaceis, olivaceis, pubescentibus, subtus punctatis, late ellipticis, 5–12 mm. longis, 4–9 mm. latis, base obtusis vel rotundatis, apice obtusis vel acutis, costa supra obscura, subtus evidens, nervis lateralibus 3 paribus, obscuris; petiolo 2 mm. longo, piloso; stipulis deltoideis, 0.5 mm. longis, acutis, persistentibus; inflorescentiis floris ♂ subfasciculatis, axillaribus, singulis, 1 vel 3-floribus, pedunculis 3–4 mm. longis; pedicellis 1.5–4 mm. longis, pilosis; calycibus patelliformibus, 2 mm. diametro, sparse pubescentibus, lobis 4, deltoideis, erosis ciliatisque; corolla subrotata, 4 mm. diametro, petalis ovatis, 1.5 mm. longis, base leviter connatis; staminibus quam petalis brevioribus; ovario abortivo subgloboso; floribus ♀ et fructibus non visis.

CHINA: Kwangsi: Tseung-yuen, Yao-shan, *C. Wang 39504* (TYPE, A).

Ilex subcrenata is a shrub occurring in a dense shaded habitat, as re-

corded by Wang. In northern Kwangsi, the white flowers appear in late June. In its punctate leaves and 4-merous flowers it is closely related to *Ilex crenata* Thunb., but the latter species has a much more compact habit, larger and glabrous leaves, and eciliate calyx. In general the staminate inflorescences of *Ilex crenata* are solitary and axillary to leaves of the current year's growth. The fasciculate cases are rare. On account of its punctate leaves I think it should be placed in the series Stigmatophorae. Chun in Sunyatsenia recorded the plant as *Ilex oblata* (Evans) Comber = *Ilex nothofagifolia* Ward. This is an error, for *Ilex nothofagifolia* is a glabrous tree with verruculose branchlets and epunctate leaves.

Ilex yuiana sp. nov. Sect. Paltoria.

Frutex sempervirens, ramulis gracilibus, subteretis, densis pubescentibus; trienniis 3 mm. diametro, hornotinis 1–1.5 mm. diametro, gemmulis terminalibus debilibus; foliis coriaceis, olivaceis, supra leviter nitidis, minute puberulis, subtus opacis, pubescentibus punctatisque, ellipticis, 1–3 cm. longis, 8–14 mm. latis, base obtusis, vel acutis, apice acutis cuspidatisque, costa supra impressa, subtus elevatis, nervis lateralibus utrinque obscuris; petiolo 3–4 mm. longis, dense pubescentibus; stipulis squamosis, 1 mm. longis, persistentibus; inflorescentiis solitariis, axillaribus, pedicellis fructus 10–12 mm. longis, pubescentibus; fructibus depresso-subglobosis, 5–7 mm. diametro, calycibus persistentibus 3–4 mm. diametro, lobis acutis, pubescentibus ciliatisque, stigmate discoideis; pyrenis 4, 5 mm. longis, 3.5 cm. latis, levibus, endocarpio coriaceo.

CHINA: Yunnan: Taron in Kiu-kiang Valley, *T. T. Yü 20181* (TYPE, A), *20884* (A).

The distribution of this species seems to be limited to Kiu-kiang Valley of northwestern Yunnan. There, as reported by Yü, it is occasional at an altitude of 1350 m., and common at 2300 m. In having punctate and pubescent leaves it resembles *Ilex triflora* Blume, but the latter species has much larger leaves (3–9 cm. long) and fasciculate fruits. It can easily be distinguished from *Ilex crenata* Thunb. by its thick indumentum and from *Ilex szechwanensis* Loes. by its uniformly small leaves. Its small leaves and pubescent branchlets suggest remote relationship with *Ilex yunnanensis* Franch., but this latter species has epunctate leaves. On account of its punctate leaves this species should fall into the series Stigmatophorae.

Ilex miguensis sp. nov. Sect. Aquifolium.

Frutex sempervirens, ramulis glabris, cinereis, hornotinis 2–2.5 mm. diametro, gemmulis terminalibus, conicis, glabris; foliis coriaceis, olivaceis, utrinque nitidis, ellipticis, 1.5–3 cm. longis, 7–15 mm. latis, basi acutis, raro obtusis, apice acutis spinulosisque, margine remote serratis, dentibus spinosis, costa supra impressa, subtus elevata, nervis lateralibus 4 vel 5 paribus, supra impressis, subtus prominentibus, reticulis subtus evidentibus; petiolo 3 raro 4 mm. longo, glabro; stipulis minutis, persistentibus; inflorescentiis paucifasciculatis, axillaribus; floribus plerumque paribus,

pedicellis 3 mm. longis, glabris, prophyllis 2, basalibus; fructibus rubris, subglobosis, 4 mm. diametro, calycibus persistentibus quadrangularibus; 2 mm. diametro, eciliatis; stigmate discoideo, minute; pyrenis 4, 3 mm. longis, 2 mm. latis, ligneis, dorso palmatim striatis et esulcatis.

CHINA: Sikang (Eastern Tibet): Rong-tö, above Migu, Zayul, *F. K. Ward 11019* (TYPE, B; fragment, A).

Ilex miguensis is a rare undergrowth in the upper forest of Rong-tö Valley in southern Sikang. It occurs at an altitude of 3300 to 3600 m. In the small size and elliptic shape of the leaves, the impressed nerves on the upper surfaces of the leaves, and the striate and esulcate pyrenes, this species has some resemblance to *Ilex perryana* S. Y. Hu, but the latter species has only one or two spines on each side of the leaves. Moreover, the fruit has only one pyrene. In the more numerous weak-spinose leaves this species resembles *Ilex ciliospinosa* Loes., but the latter has pubescent branchlets and 2-pyrened fruits. On account of its spinose leaves and palmately striate woody pyrenes it can be rightly placed in the series Dipyrenae.

Ilex chuniana sp. nov. Sect. Aquifolium.

Arbor parva, ramulis gracilibus, 1 mm. diametro, striatis, pubescentibus; foliis subcoriaceis, olivaceis vel olivaceo-brunneis, utrinque opacis, epunctatis, glabris, lanceolatis vel raro angusto-ellipticis, 3–3.5 cm. longis, 9–15 mm. latis, basi acutis vel acuminatis, apice obtusis, margine crenato, costa supra impressa, subtus elevata, glabra, nervis lateralibus utrinque 5–6; petiolo 3–5 mm. longo, puberulo, supra canaliculato; stipulis minutis, persistentibus; inflorescentiis paucifasciculatis, axillaribus, unifloribus; pedicellis florum ♂ 2 mm. longis, glabris, prophyllis 2, basalibus; calycibus patelliformibus, 2 mm. diametro, lobis ciliatis; corolla rotata, 4 mm. diametro, petalis ovatis, 1.5 mm. longis; staminibus petalis aequilongis, antheris ovoideis; ovario abortivo subgloboso; fructibus subglobosoellipsoideis, 5.5 mm. longis, 4.5 mm. diametro, pedicellis fructuum 2 mm. longis, sparse puberulis, calycibus persistentibus quadrangularibus, 2.5 mm. diametro, ciliatis, stigmate discoideo, 4-lobo; pyrenis 4, 4.5 mm. longis, 3 mm. latis, striatis et esulcatis, pilosis, lignescentibus.

CHINA: Hainan: Ling-shui, *N. K. Chun & C. L. Tso 44368* (NY.); Ting-on, *C. Wang 33904* (TYPE A; US).

The description of the fruits is drawn from *Chun & Tso 44368*.

Ilex chuniana is named after Prof. Y. W. Chun, Director of the Botanical Institute, Sun Yatsen University, Canton, China. It is a small tree occurring in the tropical forests of Hainan at an altitude of ca. 1000 m. According to Wang, its yellow-white flowers appear in late December. The fruits are red and remain on the plant until November of the next year. The lanceolate crenate leaves and fasciculate inflorescences suggest a close relationship with *Ilex peiradena* S. Y. Hu, but the latter has punctate leaves which are twice as long. Moreover the staminate fascicles of *Ilex peiradena* have cymose individual branches, and those of *Ilex*

chuniana have only single-flowered branches. On account of its subcoriaceous leaves, short fruiting pedicels, and palmately striate and sulcate pyrenes, this species should be placed in the series Repandae.

Ilex liana sp. nov. Sect. Aquifolium.

Arbor (?) sempervirens, ramulis robustis, glabris, rugosis tuberculatisque, trienniis 7 mm. diametro, lenticellis ellipticis, elevatis, hornotinis 5 mm. diametro, striato-sulcatis, gemmulis terminalibus et axillaribus, magnis, ovoideis, perulis puberulis; foliis coriaceis, olivaceis, glabris, utrinque opacis, ovato-oblongis, raro ovatis, 8–9 cm. longis, 4.5–5.5 cm. latis, basi rotundatis, apice acutis, margine crenulatis, costa supra impressa, subtus valide elevata, nervis lateralibus 17–18 paribus, utrinque prominentibus, reticulis densissimis, utrinque distinctis; stipulis obscuris; petiolo subterete, 2 cm. longo, glabro; inflorescentiis pseudo-paniculatis, axillaribus, singulis 1-vel 3-floribus, rhachibus 1 cm. longis, rugosis, bracteis ovatis, puberulis ciliatisque, caducis, pedicellis 5–6 mm. longis, glabris vel sparse puberulis, prophyllis 2, basalibus; floribus non visis; fructibus parvis, globosis, 4 mm. diametro, calycibus persistentibus 3 mm. diametro, ciliatis, stigmate discoideo, 4-lobo; pyrenis 4, 2.5 mm. longis, 1.5 mm. latis, pilosis, palmatim striato-sulcatis et rugosis, ligneis.

CHINA: Yunnan: *M. K. Li 1099* (TYPE, A).

Ilex liana, though insufficiently known, is a very distinct species. Its stout branchlets, large buds, pseudopaniculate infructescenses, small fruits, and 4 pilose pyrenes all indicate close relationship with *Ilex sikkimensis* Kurz, but the average leaves of the latter species are twice as large as those of this Yunnan species. Moreover, the venation of a carbon rubbing of the type of *Ilex sikkimensis* is of an entirely different nature. The numerous lateral nerves and the prominent reticulation of the veinlets of *Ilex liana* suggest the venation of *Ilex venulosa* Hook. f., but this species has a very different type of inflorescence. The glabrous branchlets, the coriaceous leaves, and the pseudopaniculate inflorescences indicate some relationship with *Ilex latifolia* Thunb., and I think its natural position should be in the series Denticulatae. It differs from *Ilex latifolia* by having small fruits and smaller leaves with numerous lateral nerves.

In my work on the genus *Ilex* in China, in the key to the sections of the subgenus Prinos, I wrote for the section Prinoides, "Mature fruit black; the pyrenes rugose . . . " Also in the description of the same section I had "Deciduous trees or shrubs with . . . black mature fruit." Later studies and field observations have proved that these statements are insufficient to cover the fruit color of all the species included in this section, for some of them have red fruits. So in both statements a phrase "or red" should be inserted in referring to the color of the fruit.

Luculia yunnanensis sp. nov.

Luculia gratissima sensu How in Sunyats. **7**: 27. 1948, non Sweet.

Frutex usque ad 3.5 m. altus; ramulis teretibus, distincte lenticellatis,

pubescentibus, 3–5 mm. diametro, internodiis 2–3 cm. longis; foliis coriaceis, supra glabris, subtus ad nervis crispato-pubescentibus, oblanceolatis, 9–18 cm. longis, 2–5 cm. latis, acuminatis, acumine 1–2 cm. longo, basi cuneatis, costa supra plana, subtus elevata, nervis lateralibus utrinque ca. 14, supra impressis, subtus vix elevatis, perspicuis, reticulis distinctis; petiolo subterete, 1–1.5 cm. longo, glabrescente; stipulis ovato-lanceolatis, caducis, 1 cm. longis; inflorescentiis paniculato-corymbosis, ramulis terminalibus cymosis, cymulis 2- vel 3-floris, bracteis linearibus, 0.5–1.5 cm. longis, deciduis; pedunculis 2 mm. longis, tomentosis; pedicellis 3–5 mm. longis, tomentosis; receptaculis obconicis, tomentosis, 5 mm. longis, 2 mm. diametro; calycis lobis oblanceolatis, 12–15 mm. longis, 3 mm. latis, pubescentibus, ciliatis, acutis, basi cuneatis; corolla hypocrateriforme, rubescente, tubo cylindrico, 2.5–3 cm. longo, limbo 3–5 cm. diametro, lobis 5, obovatis, 1.3–1.5 cm. longis, 9–12 mm. latis, basim versus in utroque latere cristis descendentibus intrasinum confluentibus ornatis; staminibus 5, filamentis 1.5 mm. longis, antheris 5–6 mm. longis; vix exsertis; ovario 2-loculare, ovulis numerosissimis, stylis 2.5 cm. longis, stigmate carnoso, 2-lobis, 4 mm. longis; fructibus oblongo-obovoideis, 2 cm. longis, 8 mm. diametro, pubescentibus, longitudinaliter 12-striatis; seminibus minutis, 0.5 mm. diametro, rugosis, alatis, ali terminalibus, albis, 1–2 mm. longis.

CHINA: Yunnan: Chih-tse-lo, *H. T. Tsai 54178* (A), *58561* (A), *58474* (A); Shang-pa-hsien, *H. T. Tsai 54289* (A), *54397* (A), *54671* (A), *54693* (A), *54851* (A), *56598* (TYPE, A), *58856* (A), *58970* (A), *59020* (A); Chui-kiang, west of Cham-pu-tung, *C. W. Wang 67469* (A); Kiu-kiang Valley (Taron), *T. T. Yü 19914* (A), *20381* (A), *20993* (A).

This species is easily distinguished from the other described forms by its tomentose receptacles, its flap-like continuous processes on and between the lobes of the corolla, and its oblanceolate leaves. It occurs in northwestern Yunnan. It has been reported as rare at 1700 m. and common at 2300–2500 m. Its flowers are attractive and fragrant, appearing chiefly in September and October, but occasionally as early as August and as late as Nòvember.

Morinda brevipes sp. nov.

Frutex scandens, ramis teretibus, glabris, ramulis ultimis 2 mm. diametro, breviter pubescentibus, internodiis 5–25 mm. longis; foliis glabris, integerrimis, chartaceis, olivaceis, ellipticis vel oblanceolatis, 6–10 cm. longis, 1.8–2.8 cm. latis, acuminatis, basi acutis vel cuneatis; apice acutis vel breviter acuminatis; costa supra et subtus elevata, glaberrima, nervis lateralibus utrinque 5–7, supra evidentibus, subtus prominentibus, subtus distincte reticulatis; petiolo 5–9 mm. longo, minute pubescente; stipulis tubiformibus, 4 mm. longis, truncatis, minute pubescentibus, seta 0 vel 1; inflorescentiis fasciculatis, terminalibus, pedunculis 3–4 mm. longis, hispidis, bracteis ovato-deltoideis, 3 mm. longis; capitulis 4–6 mm. diametro, pilosis, 14 ad 16 floribus, receptaculis coalescentibus, setiferis; calycibus

cupuliformibus, 2 mm. diametro, integerrimis, persistentibus; corolla infundibulari, tubo 2 mm. longo, fauce barbato, limbo 5 mm. diametro, lobis 4, apicibus uncinatis; staminibus 4, leviter exsertis, antheris linearibus; disco annulario; stylo 0, stigmate discoideo; syncarpiis subglobosis, breviter pubescentibus, 12 mm. diametro.

CHINA: Hainan: Yai-chow, *F. C. How 70435* (A); Po-ting, *F. C. How 71754* (TYPE, fruit, A).

This distinct species can easily be distinguished from other known forms by its terminal capitula with very short peduncles which are much shorter than the mature fruit. In Hainan Island this plant grows at an altitude of 420 meters in forest or woods, "twining on shrub" as reported by How. Its yellowish green flowers appear in April. The mature fruit is red.

The description of the flower is drawn from *How 70435*.

Morinda howiana sp. nov.

Frutex scandens, ramulis glaberrimis, 2–2.5 mm. diametro, internodiis 1.5–5 cm. longis; foliis chartaceis, brunneis, ellipticis, 6–12 cm. longis, 2–5 cm. latis, breviter acuminatis, basi obtusis vel rotundis; costa supra plana, glaberrima, subtus elevata, glabra, nervis lateralibus utrinque ca. 9, supra obscuris, subtus elevatis, axillis villosis, subtus perspicue reticulatis; petiolo 6–10 mm. longo, breviter pubescente; stipulis tubiformibus, 5–7 mm. longis, glabris, truncatis, setis 4; inflorescentiis fasciculatis terminalibus, pedunculis 8–14 mm. longis, raro longioribus, minute pubescentibus, bracteis ovatis, basi connatis vel liberis; capitulis 9- ad 12-floribus, 4 mm. diametro, glaberrimis, setiferis; receptaculis coalescentibus; calycibus cupuliformibus, integris, ciliatis; corolla infundibulari, tubo brevi fauce barbato, limbo 4–5 mm. diametro, petalis 5, apicibus uncinatis; staminibus 4, antheris linearibus; disco tumido; stylis 1–2 mm. longis, stigmate bifidis; syncarpiis subglobosis, 8–14 mm. diametro.

CHINA: Hainan: Fan-yah, *Chun & Tso 44216* (A); No-dao, *J. L. Gressitt 976* (A); Po-ting, *F. C. How 71911* (TYPE, flower, A), *73386* (fruit, TYPE, A); Ngai-hsien, *S. K. Lau 334* (A); Ch'ang-kiang, *S. K. Lau 1741* (A); Taam-chou, *W. T. Tsang 60* (A), *89* (A); Nor-tai, *Herb. Hongkong 401* (A).

This species can be distinguished by its broad elliptic glabrous leaves with tufts of villose pubescence in the axils of the lateral nerves on the lower surfaces. The presence of bristles on the glabrous capitulum is also very characteristic.

Morinda hupehensis sp. nov.

Frutex scandens, ramulis pubescentibus, internodiis 1–5 cm. longis; foliis chartaceis, olivaceis, utrinque pubescentibus, integerrimis, oblanceolatis vel ellipticis, 7–9 cm. longis, 2–3 cm. latis, acuminatis, basi obtusis, raro acutis, costa supra plana, subtus elevata, nervis lateralibus utrinque 7–9, supra obscuris, subtus prominentibus; petiolo 6–8 mm. longo, molle; stipulis tubiformibus, 4 mm. longis, truncatis, pubescentibus, 4-setis;

fructibus terminalibus, fasciculatis, pedunculis 5–8 mm. longis, pubescentibus, bracteis aciculatis, syncarpiis rubris, depresso-subglobosis, 8–10 mm. diametro, pubescentibus, calycibus persistentibus cupuliformibus, integris.

CHINA: Hupeh: En-shih, *H. C. Chow 1818* (TYPE, A).

The size of the leaves and the indumentum of the plant of this species resemble those of *M. hainanensis* Merr. & How, but the latter species can be readily distinguished by its distinct deltoid calyx lobes which are persistent on the capitulum, and its longer peduncles which are 10–13 mm. long.

EXPLANATION OF PLATE

FIGURES 1–3, the male flower of *Fokienia:* FIG. 1. A cone terminal to a branchlet, with two whorls of leaves shown (× 10). FIG. 2. A cone scale, dorsal view (× 25). FIG. 3. The same, ventral view (× 25). FIGURES 4–11, various forms of seed of *Fokienia* (× 2): FIG. 4. From *Ching 2361* (Chekiang). FIG. 5. From a young cone of *Keng 350* (Chekiang). FIG. 6. From an older cone of the same specimen. FIG. 7. From B. Hayata in 1917 (Tonkin). FIG. 8. From *Poilane 6527* (Tonkin). FIGS. 9 & 10. Two seeds from different scales of one cone from *Tsiang 8867* (Kweichow). FIG. 11. From Gressitt (E. Kwangtung). FIGURES 12–15, *Sauropus changiana:* FIG. 12. Habit sketch (× 1). FIG. 13. A male flower with the perianth segments mechanically spread (× 5). FIG. 14. A fascicle with one female flower shown (× 5). FIG. 15. A bract (× 12).

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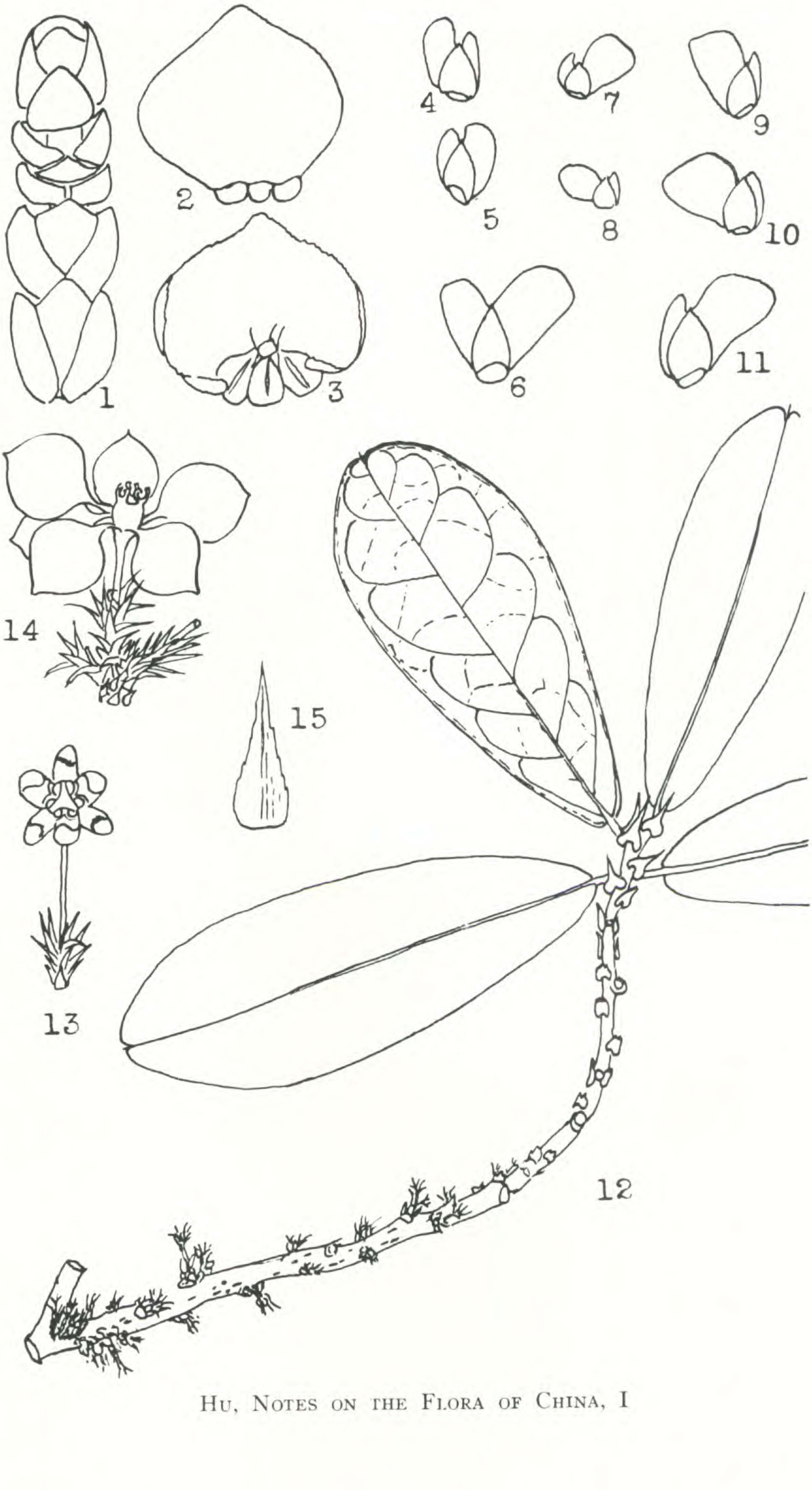
HARVARD UNIVERSITY.



HU, NOTES ON THE FLORA OF CHINA, I

STUDIES IN THE THEACEAE, XXIV
THE GENUS SLADENIA

CLARENCE E. KOBUSKI

With one plate

The genus *Sladenia* was first described by Kurz in Jour. Bot. 11: 194, *t. 133, f. 1.* 1873 from Yunnan, China, and was named after Major E. B. Sladen, "the energetic head of the Yunan expedition." This expedition was from Burma to southwestern China by way of the Irrawaddy and Bhamo. Kurz, in working up the plants from this expedition, recognized the genus as new and belonging to the Theaceae. In describing it he suggested a relationship close to *Cleyera* or *Ternstroemia*. The description of the genus was based on flowering material, and until now the mature fruit has not been described. Kurz proved to be very astute in his recognition of the rightful position of the genus! However, since 1873 the genus has been transferred to three other families, namely, the Dilleniaceae, Linaceae, and Actinidiaceae.*

A short resumé of the history of the genus follows. At first, it appears, no botanist seemed willing to admit *Sladenia* to the Theaceae. This, I presume, was because of the dichasial cyme, an inflorescence quite alien to the family, and the unusual, low-numbered stamens. Dyer in Fl. Brit. India, the year (1874) after its description, records the genus. This volume evidently was prepared simultaneously with Kurz's original description, since it refers only to the manuscript of Kurz.

Gilg (Nat. Pflanzenfam. III. 6: 128. 1893) removed *Sladenia* from the Theaceae and placed it questionably in the Dilleniaceae in company with *Actinidia, Clematoclethra,* and *Saurauja,* and in 1925, in the second edition of the same work, Gilg and Wedermann continue the relationship of these four genera in their newly created family Actinidiaceae. There they already state that *Sladenia* varies in anatomy from the other three members. Gilg's persistence in associating *Sladenia* with *Actinidia, Clematoclethra,* and *Saurauja* has had considerable influence on most botanists, since *Sladenia* is usually filed in most herbaria with either Dilleniaceae or Actinidiaceae, if the latter family is recognized as such.

It might be mentioned here that Hallier in his study of the Linaceae (Beih. Bot. Centralbl. 39(2): 137. 1923) placed *Sladenia* in this family. However, this move was never recognized and has received no support.

It is strange that a genus so distinct and yet so often misplaced in herbaria has not been redescribed under other names. Yet, as far as is

*Dr. Hui Lin Li, in his work on the Actinidiaceae, recently wrote me that, in his opinion, *Sladenia* did not belong in the Actinidiaceae, and suggested its return to the Theaceae.

known, no synonyms have appeared in literature. The genus has been often collected. In the herbarium of the Arnold Arboretum alone are found fourteen specimens from Yunnan and three from Burma.

Evidence of its true position was accumulated by the late Prof. Rehder, in seeking to identify a specimen collected in Yunnan. Up until that time (1936) *Sladenia* was placed in our herbarium under Dilleniaceae. Rehder thought that he had before him a new genus and planned to describe it as such. He sent material to Dr. Roger P. Wodehouse for comments on the pollen and to Prof. I. W. Bailey and the late Prof. S. Record for anatomical information. The separate responses of these three authorities are very interesting and are worthy of quotation in part.

Dr. Wodehouse responded as follows: "The pollen of your Asiatic shrub (Henry 11884) confirms its association with the Theaceae. Compare, for example with the figure of *Ternstroemia granulata* (Pl. 21, fig. 22. Bull. Torrey Club 59. 1932). In case you wish to include the pollen grain in your description, I offer you the following (description) and the enclosed figure." The technical description follows in the discussion of the species and the figure is included on the plate.

Prof. Record responded to Prof. Rehder's inquiry as follows: ". . . and of the four families you mention (Celastraceae, Theaceae, Tiliaceae and Flacourtiaceae) it seems to me that the only one possible is Theaceae. As for the genus I suggest *Eurya*." No record of any correspondence with Prof. I. W. Bailey can be found, and his response to Prof. Rehder must have been verbal. However, Prof. Rehder, in his reply to Record, stated that wood had been given also to Bailey for examination and that Bailey had agreed with Record's conclusion.

Metcalfe & Chalk, in their recent work on the anatomy of the dicotyledons, placed *Sladenia* among the "Anomalous genera" of the Theaceae.

It is interesting to note here that Wodehouse, through the study of the pollen, placed the genus close to *Ternstroemia*, while Record, through anatomical study, suggested its relationship with *Eurya*. It is interesting to further note that Kurz in his original description stated that "This new genus apparently comes near Cleyera or Ternstroemia." In the herbarium of the Arnold Arboretum, the genus is listed 10 A, immediately following *Ternstroemia* and preceding *Adinandra*, *Eurya*, and *Cleyera*.

Because of the dichasial cyme, the low number of stamens (ca. 10) with pilose anthers and enlarged filaments, it may be advisable to separate the genus from its closest relatives by the designation of a new subtribe, **Sladeniinae**.

This would place the genus in the tribe Ternstroemieae between the two subtribes Ternstroemiinae and Adinandrinae. In the Adinandrinae are found *Adinandra* and *Cleyera*, both with pilose anthers and *Visnea* with a reduced number of stamens.

Gilg and Werdermann designated a subfamily Sladenioideae and a tribe Sladenieae for the single genus in the family Actinidiaceae. However, at the same time they designated a subfamily and tribe for each of the four

genera in the family! Either of these designations is too distinctive for *Sladenia* in the Theaceae and would not fit well in the classification as designated by Melchior in his treatment of the Theaceae, a classification of which I wholeheartedly approve.

Sladenia Kurz in Jour. Bot. 11: 194. 1873; For. Fl. Brit. Burma 1: 100. 1877. — Dyer in Hooker f. Fl. Brit. India 1: 281. 1874. — Gilg in Nat. Pflanzenfam. III. 6: 128. 1893, sub *Dilleniaceae*. — Hallier f. in Beih. Bot. Centralbl. 39(2): 137. 1923, sub *Linaceae*. — Gilg & Werdermann in Nat. Pflanzenfam. ed. 2, 21: 46. 1925, sub *Actinidiaceae*. — Metcalfe & Chalk, Anat. Dicot. 1: 188. 1950.

TYPE SPECIES: *Sladenia celastrifolia* Kurz.

Sepals 5, imbricate, persistent, scarious. Petals 5, elliptic-oblong, connate at the base. Stamens 10 (rarely 11–13), uniseriate; filaments short, thickened at base, constricted and introrsely flexed at the apex; anthers introrse, basifixed, lanceolate, pilose, bifid at apex, sagittate at the base; pollen grains uniform, tricolpate. Ovary superior, conical, 3-celled, tapering at apex into elongated style lightly three-parted at the apex; ovules 2 to each cell, pendulous, anatropous. Fruit indehiscent ? capsule, 3-celled, exocarp chartaceous, endocarp crustaceous. Seeds 2 to each cell, suspended from apex, elongated subtriangular when fresh, irregularly winged when dry; testa transparent, finely reticulate; embryo elongated; endosperm lacking.

Shrubs or trees. Leaves alternate, exstipulate, subcoriaceous. Inflorescence axillary, dichasial cymes.

In the above generic description it will be noted that the fruit has been recorded as indehiscent, followed with a question mark. In all the fruit examined during this study none was seen that was dehiscent, hence one would assume the fruit to be indehiscent. However, Gilg and Werdermann refer to the fruit of *Sladenia* in their treatment of the Actinidiaceae as splitting along the septa into three cocci. I found in making sections of the fruit that there was a tendency for the fruit to split very easily along the septa, hence my caution in designating the fruit as indehiscent. Furthermore, some of the largest fruits found (*Yü 18183*) were recorded as "capsule green, young," which may signify that even up to the present time no truly mature fruit has been seen.

Sladenia celastrifolia Kurz in Jour. Bot. 11: 194, *t. 133, f. 1.* 1873; For. Fl. Brit. India 1: 281. 1874. — Dyer in Hooker f. Fl. Brit. India 1: 281. 1874. — Sprague in Hooker's Icon. 31: *t. 3026*. 1915. — Craib, Fl. Siam. Enum. 1: 126. 1925. — Kobuski in Brittonia 4: 118. 1941.

Shrub or small tree up to 18 m. high; branchlets terete, glabrous, occasionally somewhat angled and pubescent at apex of young growth. Leaves subcoriaceous, ovate to elliptic-oblong 5–12(–15) cm. long, 2–4.5(–5.5) cm. wide, acuminate at the apex, cuneate at the base, glabrous on both surfaces (rarely lightly pubescent on midrib of under surface), the mar-

gin serrate, the midrib plane on the upper surface, somewhat canaliculate toward the base, elevated below, the lateral veins conspicuous on both surfaces, 6–8 pairs, rising obliquely from the midrib, anastomosing near the margin, the petiole 7–10 mm. long. Inflorescence axillary, dichasial cyme, 2–4-forked, the flowers articulate; peduncle lightly pubescent, ca. 10 mm. long, the branches and pedicels of the inflorescence ca. 5 mm. long, the terminal or ultimate flowers subsessile or with pedicel 1–2 mm. long. Sepals 5, imbricate, glabrous, unequal, elliptic-oblong, ca. 4.5–5 mm. long, 1.7–2.5 mm. wide, somewhat rounded at the apex, scarious, somewhat thickened in the center, ciliate. Petals 5, unequal, 4.5–6 mm. long, 2–3 mm. wide, lightly connate at the base, obovate-oblong, rounded at the apex. Stamens usually 10, occasionally 11–13, uniseriate, lightly adnate to the base of the petals; filaments short, ca. 1.5 mm. long and 0.7–0.8 mm. diameter, rounded and thickened at the base, constricted and introrsely flexed at the apex, glabrous; anthers introrse, lanceolate, ca. 2 mm. long, pilose, bifid at the apex, sagittate at the base, dehiscing by apical pores. Pistil conical, ca. 4 mm. long, vertically striate; ovary ovoid, glabrous, 3-celled, tapering at the apex into a 3-parted style, the cells with two pendulous elongated ovules attached at the apex. Fruit indehiscent ? capsule, grayish, glabrous, flask-shaped tapering from a globular lower portion into an elongated beak, 7–8 mm. long, vertically striate, 3-celled, each cell 2-seeded; the exocarp chartaceous, reddish on the inside, the endocarp crustaceous light gray or white. Seeds freely pendent from the apex of the cell by thin membrane, elongate, ca. 3 mm. long, the testa thin, transparent and finely reticulate, when dry appearing 3-winged, when fresh swollen and apparently triangular, the embryo long, endosperm lacking.

DISTRIBUTION: China (Yunnan), Burma and Siam.

CHINA: Yunnan: Szemao, W. Mts., alt. 5000 ft., *A. Henry 11884, 11884 A* (tree 15–40 ft. with white flowers); E. Mts., alt. 4500 ft., *A. Henry 11884B* (tree 30 ft.). — Between Kuan ni and Enlo, edge of forest on bank of Black River, alt. 3500 ft., *J. F. Rock 2955*, March 27, 1922 (tree 40 ft.). — Shweli watershed between Tengyneh and Lungling, *J. F. Rock 7191*, Oct.-Nov. 1922 (shrub 15–20 ft.). — Mienning, north of city among forest in valley, alt. 1700 m., *T. T. Yü 18183*, Nov. 3, 1938 (shrub or small tree 15 ft.; capsule green, young). — Fo-hai, thickets, alt. 1540 m., *C. W. Wang 74171, 74238, 74503, 77134*, May 1936 (10–15 ft. high with white flowers). — Lan-Tsang-Hsien, in mixed woods, alt. 1800 m., *C. W. Wang 76656*, May 1936 (fls. white). — Maan-tsing, Sheau-meng-yeang, Luh-shuen-Hsien, in thickets, alt. 1000 m., *C. W. Wang 81148*. — In open thickets in side valleys of the western flank of the Tali Range, lat. 25°40′, alt. 9–10000 ft., *G. Forrest 11653*. Sept. 1913. — Precise locality lacking, *G. Forrest 15530*.

BURMA: Ngawchang Valley, in forest, common in gullies, *F. Kingdon Ward 104* (Vernay-Cutting Exped.), Dec. 12, 1938. — Kang-fing, Ngawchang Valley, north of Htawgaw, common in subtropical evergreen hill forest, in riverbed, alt. 4000 ft., *F. Kingdon Ward 172* (Vernay-Cutting Exped.), Dec. 28, 1938. — Gaungyi, *F. A. Dickason 5848*, Aug. 5, 1933.

As mentioned earlier in this study, Dr. Wodehouse kindly furnished a technical description of the pollen. This description is quoted below, along with Dr. Wodehouse's interesting comments:

"Pollen grains uniform, broadly ellipsoidal, 15.4 × 17.1μ; tricolpate, with furrows long and tapering to pointed ends, without internal thickenings, their membranes minutely flecked, without a well defined pore but more or less bulging in the center; exine moderately thick, smooth or faintly and finely granular; intine thin, slightly thickened beneath the furrows.

"This grain almost exactly matches that of *Ternstroemia granulata* Kr. & Urb., differing principally in the smoother texture of its exine. It is also similar to those of Ochnaceae, being almost exactly matched by that of *Neckia serrata*. It is similar to those of Flacourtiaceae but can be distinguished by its lack of the internal thickenings along the furrow margins, which characterize the grains of the latter family, a character which is found to be more significant than its inconspicuousness in appearance would suggest.

"It is rather interesting that when I first got your pollen sample I attempted to key it out, using the key in my book and the one in the Torrey Bulletin referred to above; the pollen ran right out to Theaceae. I rejected this answer because I did not know that the Theaceae could have anthers opening by apical pores, and I knew that my pollen records were far from complete, with many unfilled gaps where this specimen might very well belong. I believe that if my records had been complete, the pollen would have told at once that the specimen belonged either to the Theaceae or Ochnaceae — the grains of the two are essentially the same."

EXPLANATION OF PLATE

Sladenia celastrifolia Kurz. All figures except habit sketch enlarged. The drawing of the pollen grain is highly magnified and has been contributed by Dr. R. P. Wodehouse.

FIG. 1. Habit. FIG. 2. Open flower. FIGS. 3–5. Stamens. FIGS. 6–8. Ovary. FIG. 9. Pollen grain. FIG. 10. Seed (habit and cross-section).

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

SLADENIA CELASTRIFOLIA KURZ

ON THE IDENTITY OF THE GENUS BARANDA LLANOS

E. D. MERRILL

IN 1857, FATHER LLANOS, who attempted without much success to carry on the botanical work of Father Blanco who had died in Manila in 1845, very inadequately described the new genus *Baranda*.* His material was from forests near Angat, Bulacan Province, Luzon. F.-Villar in 1880, without discussion, unhesitatingly reduced the genus to *Barringtonia* Forst., and the species to the extra-Philippine *B. macrostachys* Kurz. This disposition of the genus was accepted by the authors of Index Kewensis.

In 1918 when I first considered the genus, Sp. Blancoanae 382. 1918, and again, Enum. 3: 143. 1923, I could not determine its status from the very meager description, and in 1923 left it as a genus of doubtful status at the end of the Lecythidaceae. The original very inadequate description is as follows:

"*Baranda Angatensis*. Arbor foliis ad extremitatem confertis, cuneatis, integerrimis, glaucis, glabris. Flores ad apices trunci orti, racemosi. Calyx 5-fidus laciniis rotundatis. Stam - - -. Stylus 1. Germen - - -. Nux minima, magnitudine pisi (an matura grandior?) exangulata, 2–3 loculares. Seminibus - - - Nominavi ad memoriam cl. lithologi D. Isidori de Baranda, qui in Philippinis minarum inspector fuit."

In the meantime, however, Hallier, Beih. Bot. Centralbl. 39(2): 94. 1921, in continuation of his discussion of his correct reduction of *Suringaria* Pierre to *Symplocos* Jacq., had correctly reduced *Baranda* Llanos to *Symplocos* Jacq., as he stated the case: "*Baranda angatensis* Llanos (Wälder bei Angat; Llanos in Herb. Lugd.-Bat.) im Kew-index gleichenfalls zu *Barringtonia* statt zu *Symplocos* ((*oblongifolia*) Vidal!) gebrachte worde." This reduction, obscurely published in the course of a long discussion, which was rather characteristic of Hallier's presentation of often important conclusions, escaped my attention entirely; but Knuth, in his monographic treatment of the Barringtoniaceae, Pflanzenreich 105(IV. 219): 73. 1939, noted it. He correctly eliminated *Baranda* Llanos from the Barringtoniaceae, making it a synonym of *Symplocos* Jacq. as Hallier had correctly concluded.

In August, 1950, in examining various types of Malaysian species in the Rijksherbarium, Leiden, I noted this Llanos specimen. It was collected in forests near Angat in May, 1854, and was sent to Blume by Llanos, apparently in order to secure an expression of opinion regarding the proposed new genus. The specimen is with immature fruits. The short and very incomplete description is somewhat misleading. Thus the "flores ad species truncti orti" really refers to the spikes (not racemes)

*Mem. Acad. Cienc. Madr. III. 2: 502. 1857; F.-Vill. & Naves in Blanco, Fl. Filip. ed. 3, 4(1): 102. 1880.

being arranged along the ultimate branchlets below the leaves. No data were given by Llanos as to whether the leaves were alternate or opposite, and the petals and stamens were unknown to him; neither did he indicate whether the ovary was superior or inferior. The descriptive phrase "foliis - - - cuneatis" applies only to the base of the leaves.

It is well known that Llanos did send some Philippine botanical material to the De Candolle herbarium in Geneva; but this is the first case of record where he sent material to the Rijksherbarium in Leiden. Incidentally it is apparent that Blanco also sent some material to Blume in Leiden, although probably not much. The only Blanco specimen that I noted in the Rijksherbarium is a single specimen (actually a single detached leaf) of *Ficus glomerata* Blanco (non Roxb.) = *Ficus minahassae* Miq.

Thus it is that the generic name *Baranda* Llanos (1757) is a synonym of *Symplocos* Jacq. (1760). The synonymy of the species, as at present understood is:

Symplocos polyandra (Blanco) Brand, Pflanzenr. 6(IV. 242): 36. 1901, quoad syn. Blanco, excl. descr.; Merr. Sp. Blancoanae 304. 1918, Enum. 3: 301. 1923.

Guettarda polyandra Blanco, Fl. Filip. ed. 2, 500. 1845.
Carlea oblongifolia Presl, Epim. 217. 1851.
Symplocos oblongifolia Rolfe, Jour. Bot. **23**: 214. 1885; Brand, Pflanzenr. **6**(IV. 242): 55. 1901.
Baranda angatensis Llanos, Mem. Acad. Cienc. Madr. III. **2**: 502. 1857; F.-Vill. & Naves in Blanco, Fl. Filip. ed. 3, **4**(1): 102. 1880; Merr. Sp. Blancoanae 382. 1918.
Barringtonia macrostachya sensu F.-Vill. Novis. App. Fl. Filip. 87. 1880, non Kurz.

This is a very characteristic and widely distributed Philippine species, represented by numerous collections. It extends from central Luzon to Palawan and Mindanao, and also occurs in Borneo. The Bornean *Symplocos superba* Brand, of which I have not seen the type, should be compared with this species. For the benefit of those who are tempted to subdivide *Symplocos* Jacq., *Baranda* Llanos (1857) is generically identical with *Carlea* Presl (1851).

Perhaps a word is in order regarding the application of the name *Symplocos polyandra* (Blanco) Brand to this strongly marked species. The type of *Guettarda polyandra* Blanco was from the same locality as the type of *Baranda angatensis* Llanos (Angat, Bulacan Province, Luzon), and *Bur. Sci. 34206 Ramos & Edano* is a topotype of both. Blanco's description is distinctly definite and can apply to no other known species in any group of plants; he was merely misled by the inferior ovary, did not note that the distinctly crowded leaves were alternate, and placed his new species in *Guettarda* because of its numerous stamens and inferior ovary: "He colocado estos árboles con la *Guettarda*, sin embargo del número de los estambres." Of the *Guettarda* species that he recognized

G. vermicularis Blanco is correctly placed as to the genus, but that species is a synonym of *G. speciosa* Linn., *G. jasminiflora* Blanco = *G. speciosa* Blanco is *Alangium chinense* (Lour.) Rehd., of the Alangiaceae, and *G. polyandra* Blanco is the *Symplocos* under consideration. Thus within the concept of a single genus Blanco included representatives of three different families of plants, the Rubiaceae, the Alangiaceae, and the Symplocaceae.

Brand was misled by Vidal's erroneous identification of certain of the latter's collections, the basis of *Symplocos villarii* Vidal, as possibly representing Blanco's species. While he accepted Blanco's specific name as "*Symplocos polyandra* (Blanco?) Brand," he states: "Descriptio a cl. Blanco data minime cum speciminibus visis congruit; sed nescio an Cl. Vidal specimen originarium cl. Blanco viderit." No Blanco type is extant, and Vidal merely referred *Guettarda polyandra* Blanco to *Symplocos villarii* Vidal, with expressed doubt, including it as a synonym of *S. villarii* Vid. thus: "*Guettarda polyandra* Blanco 2 a. ed. 500 ? (hojas enteras)," Rev. Pl. Vasc. Filip. 178. 1886. Brand's description applies to the entirely different *Symplocos villarii* Vidal (*S. pseudospicata* Vidal).

As the actual type of *Baranda angatensis* Llanos is extant, and as Blanco preserved no specimens to represent his *Guettarda polyandra*, I propose the Angat collection *Bur. Sci. 34206 Ramos & Edano* in the herbarium of the Arnold Arboretum, duplicates of which will be found in various other herbaria, as a neotype of *Guettarda polyandra* Blanco. As noted above it is a topotype of Blanco's species and also a topotype of *Baranda angatensis* Llanos.

ARNOLD ARBORETUM,
HARVARD UNIVERSITY.

THE ARNOLD ARBORETUM DURING THE FISCAL YEAR ENDED JUNE 30, 1951

THE ARBORETUM GROUNDS have been well cared for during the past year, and in spite of several dry summers most of the collections are in excellent condition. Chemical weed killers have been used to control Poison Ivy and other weed plants. The continued use of the "blitzer" has kept the grass under control and has greatly improved the appearance of the grounds. The mist blower has permitted better control of insect pests and plant diseases, although "fire blight" was prevalent in some of the apples and pears for the first time in many years.

During the year we received 640 species and varieties of trees and shrubs including about 200 requested from American nurserymen. These new acquisitions are tested in nurseries at the Case estate and the better ones moved to the Arboretum. One hundred and fifty different kinds of trees and shrubs were added to the Arboretum collections.

Dr. Wyman spent three months in Europe during the spring of 1951, visiting nurseries, estates, and botanical gardens. He found over 600 varieties of woody plants not readily obtained in this country. These will be tested for hardiness next year in our nurseries. Every attempt is being made to make our collection as complete as possible.

More of the propagating work is being done at the Case estates. More than 800 hybrid seedlings were planted in the nurseries for final testing. Much of the experimental work of the Bussey Institute, the Cabot Foundation, and the Division of Landscape Architecture is being carried on at the Case estate.

The photographic records were continued on a large scale, using both black and white pictures and color transparencies. Dr. Wyman took 866 kodachromes and 750 black and white photographs while in Europe.

The usual numbers of Arnoldia have been published, and some of them have been reprinted in other journals. Other popular articles have been published by various members of the staff. The spring Field Class was attended by forty people, and the annual Horticultural Field Day attracted a hundred and twenty-five horticulturists. We have had many visitors, many of them from abroad, during the spring and summer months.

Mr. Fillmore has sent 264 shipments of plant material, including 948 species and varieties, to cooperating institutions in twenty countries. A total of 13,108 plants were propagated. At the suggestion of Mr. Fordham the accession records have been simplified and revised. During the year Mr. Roger Coggeshall joined the staff as Assistant Propagator.

Mr. Fillmore is continuing his experimental work on propagation. Mr. Lipp for many years was able to obtain good germination of seeds which normally germinate with difficulty by exposing them to sunlight — a method recently confirmed by a Finnish forester.

The tetraploid *Forsythia* produced at the Arboretum was awarded the Lindley Silver Medal of the Royal Horticultural Society. The triploids recently developed are even better than the tetraploid. Triploid apples obtained by crossing tetraploid *Malus Sargenti* with various diploid ornamental crabs have resulted in some very attractive new hybrids. A tetraploid *Magnolia* produced nearly ten years ago has unusually large flowers and leaves, and one of the hybrid magnolias has attracted considerable attention.

The use of tree lilacs for root stocks of common lilacs and the use of *Prunus tomentosa* as a root stock for *Prunus triloba* have now been tested for five years and appear to be entirely compatible. The tree forms produced by these root stocks are most attractive.

Comparative Morphology. — Professor Bailey has continued his investigations of the comparative morphology of the dicotyledons, devoting particular attention to the vasculature of seedlings and of leaves. Methods have been developed for clearing entire seedlings and young vegetative shoots which clearly reveal successive stages in the development of the tracheary tissue. Much time and effort have been devoted during the year to improving the condition of the wood and slide collections. The cataloguing of accessions has been completed.

The Herbarium. — During the year 9418 mounted specimens were added to the herbarium, which now numbers 663,972 sheets. A total of 16,255 specimens were received, of which 233 were sent for identification, 5072 were obtained by purchase or subsidy, and 8498 came as exchange. Of this total only 1108 were American, 432 were European, and 351 were African plants. Most of the specimens received represent the flora of Asia (8304) and that of Australia and the Pacific Islands (6030). Among the accessions of particular interest may be mentioned 2713 specimens from the East Indies received from the Herbarium Bogoriense, Java, 2314 plants of Central Asia and Siberia from the Komarov Botanical Institute, Leningrad, 2350 specimens from the rain forests of southern Bombay State, India, from Father H. Santapau, and 983 specimens from northern Japan sent by Prof. H. Hara, Tokyo.

A total of 3317 specimens were sent out during the year. Of these 1677 were transferred to the Gray Herbarium and 462 (all orchids) to the Ames Orchid Herbarium. In exchange 1178 sheets were sent out, these mainly to foreign institutions.

From fourteen different institutions the Arboretum had twenty-six requests for the loan of its herbarium material. The total specimens involved numbered 2513, of which 2068 went to twelve American and 445 to two foreign institutions. For the use of our staff forty-six lots, totaling 2116 herbarium specimens, were borrowed. These consisted of 1338 specimens borrowed from nine American and 778 from five foreign herbaria.

As a president of the Section on Nomenclature, Dr. Merrill represented the Arboretum at the International Botanical Congress in Stockholm

during July 1950. Later he worked in herbaria in Holland and England. The research of Dr. Johnston was concerned with Asiatic Boraginaceae and that of Dr. Kobuski chiefly with Asiatic Theaceae. Dr. Perry studied South Pacific Myrtaceae and Urticaceae. Dr. Hu began monographic work on *Philadelphus*. Dr. Albert Steward, first as part-time staff member and later as a Guggenheim Fellow, used the herbarium and library in the preparation of a Flora of the Lower Yangtse Valley, China.

The Library. — During the fiscal year ended June 30, 1951 there were 385 volumes added to the library; these were acquired through purchase, exchange, gifts, or binding. The total number of bound volumes on the shelves of the library is 47,728. Two hundred and twenty-five pamphlets were filed, making a total of 14,867 pamphlets on file. Six hundred and fifty-three cards were added to the main catalogue and 5,134 to the Gray Herbarium species cards.

It is evident that some restrictions may have to be put upon loans to libraries not in the vicinity of the Arnold Arboretum. Most of the inter-library loans are out-going, since we seldom need any books which are not available in some of the other Harvard libraries. Our printed catalogue makes it easy for others to merely write to the Librarian at the Arnold Arboretum for a wanted volume, even though it might be found in a library nearer home. Six hundred and fifteen volumes were borrowed or loaned.

Many of the books in the main reading room, those representing the floras of the world, have been re-classified and numbered; more re-arranging was done to relieve the overcrowding of the shelves — some of the seldom used books being shifted to the upper library.

Bibliography of the Published Writings of the Staff and Students
July 1, 1950 — June 30, 1951

BAILEY, I. W. & SWAMY, B. G. L. The conduplicate carpel of dicotyledons and its initial trends of specialization. Am. Jour. Bot. **38**: 373–379, *f. 1–24*. 1951.

FILLMORE, RICHARD H. Autumn propagation. Horticulture **28**: 372. 1950.

———— Semiautomatic watering devices for propagating benches. Am. Nurseryman **93**(6): 7–8, 41. 1951.

HU, SHIU-YING. The genus Ilex in China, V. Jour. Arnold Arb. **31**: 241–263. 1950.

JOHNSTON, IVAN M. Studies in the Boraginaceae, XX. Representatives of three subfamilies in eastern Asia. Jour. Arnold Arb. **32**: 1–26, 99–122. 1951.

KOBUSKI, CLARENCE E. Studies in the Theaceae, XX. Notes on the South and Central American species of Laplacea. Jour. Arnold Arb. **31**: 405–429. 1950.

———— Studies in the Theaceae, XXI. The species of Theaceae indigenous to the United States. Jour. Arnold Arb. **32**: 123–138. 1951.

———— Studies in the Theaceae, XXII. Some new species of Theaceae in South America. Jour. Arnold Arb. **32**: 152–154. 1951.

MERRILL, E. D. A brief survey of the present status of Bornean botany. Webbia **7**: 309–324. 1950.

———— Merritt Lyndon Fernald (1873–1950). Yearbook Am. Philos. Soc. **1950**: 287–295. 1951.

———— Notes on Elaeocarpus Linnaeus. Jour. Arnold Arb. **32**: 157–200. 1951.

———— On certain nomenclatural errors in the Euphorbiaceae. Jour. Arnold Arb. **32**: 79–81. 1951.

———— On the synonymy of Jossinia reinwardtiana (Blume) Blume. Jour. Arnold Arb. **31**: 329–333. 1950.

————Tatea F. Mueller (Pygmaeopremna Merrill) and Premna Linnaeus. Jour. Arnold Arb. **32**: 73–78. 1951.

———— Unlisted technical plant names in the published works of L. Oken (1841) and J. S. Presl (1846). Jour. Arnold Arb. **31**: 264–287. 1950.

MONEY, LILLIAN L., BAILEY, I. W. & SWAMY, B. G. L. The morphology and relationships of the Monimiaceae. Jour. Arnold Arb. **31**: 372–404, *pl. 1–4*. 1950.

PERRY, LILY M. Notes on some Myrtaceae of Fiji. Jour. Arnold Arb. **31**: 350–371. 1950.

SAX, KARL. The Arnold Arboretum during the fiscal year ended June 30, 1950. Jour. Arnold Arb. **31**: 430–434. 1950.

———— Biological resources as a factor in international understanding. Scientific Monthly **72**: 300–305. 1951.

———— Can the earth feed its millions? United Nations World **5**: 22–25. 1951.

———— The cytological effects of low-intensity radiation. Science **112**: 332–333. 1950.

———— Dwarf trees. Arnoldia **10**: 73–79, *pl. 16*. 1950.

SAX, KARL. Food resources and population growth. Bull. Atomic Scientists **7:** 105–107. 1951.

———— Oakes Ames, 1874–1950. Jour. Arnold Arb. **31:** 335–349, *port.* 1950.

———— Rootstocks for lilacs. Arnoldia **10:** 57–60, *pl. 14.* 1950.

SCHWARTEN, LAZELLA. Index to American botanical literature. Bull. Torrey Bot. Club **77:** 312–322; 412–421; 518–528. 1950. **78:** 90–101; 175–181; 279–288. 1951.

VERDOORN, FRANS. The Chronica Botanica Library and Archives. Arch. Int. d'Hist. des Sciences **3:** 785–787. 1950.

———— The future of exotic cryptogamic botany. The Bryologist **53:** 1–9. 1950.

———— International Union of Biological Sciences, Botanical Section. Leaflet 2. 2 pp. 1950.

———— International Union of Biological Sciences, Botanical Section. Leaflet 3 (Organization and Aims). 2 pp. 1950.

———— Problems of Botanical Historiography. Arch. Int. d'Hist. des Sciences **4:** 448–457. 1951.

———— Seventh International Botanical Congress. O.S.R. News **2:** 154–155. 1950.

WYMAN, DONALD. Air-layering made easy. Flower Grower **38:** 30. 1951.

———— The better plant materials. Landscape Architecture (Pub. by Dept. Landscape Arch., Harvard Univ.) 19–21. 1951.

———— Colored foliage shrubs. Horticulture **28:** 377, 385. 1950.

———— Flowering shrubs in their sequence of bloom. Plants & Gardens **7:** 50–54. 1951.

———— Forty-five of the best shrubs for Massachusetts gardens. Arnoldia **11:** 1–20. 1951.

———— Fruiting habits of certain ornamental plants. Arnoldia **10:** 81–85. 1950.

———— A hedge is as good as the material it's made of. House & Garden **98**(3): 118, 119, 181, 183–185. 1950.

———— Killing woody plants with chemicals. Arnoldia **10:** 61–71. 1950.

———— The Larz Anderson collection of Japanese dwarf trees. Arnoldia **11:** 29–35. 1951.

———— Metasequoia brought up-to-date. Arnoldia **11:** 25–28. 1951.

———— New ground cover display plots at the Arnold Arboretum. Arnoldia **11:** 21–24. 1951.

———— Other shrubs not to be overlooked. Plants & Gardens **7:** 59–63. 1951.

———— Shrubs and vines, their care and maintenance. Garden Journal **1:** 10–12. 1951.

———— Shrubs of interest during two seasons of the year. Plants & Gardens **7:** 18–23. 1951.

———— Smaller street trees needed. Arnoldia **11:** 41–48. 1951.

———— Some shrubs for at least two seasons of beauty. Arnoldia **11:** 37–38, *pl. 11.* 1951.

———— Spent hops as a mulch. Plants & Gardens **6:** 207. 1950.

———— Two season trees. Horticulture **28:** 338. 1950.

KARL SAX,
Director

Staff of the Arnold Arboretum

1950 — 1951

KARL SAX, S.D., Professor of Botany and Director.

IVAN MURRAY JOHNSTON, Ph.D., Associate Professor of Botany and Associate Director. Supervisor of the Library and Herbarium.

JOSEPH HORACE FAULL, Ph.D., Professor of Forest Pathology, Emeritus.

ELMER DREW MERRILL, S.D., LL.D., Arnold Professor of Botany, Emeritus.

IRVING WIDMER BAILEY, S.D., Professor of Plant Anatomy.

BEATRIX FARRAND, L.H.D., Consulting Landscape Gardener.

RICHARD HAROLD FILLMORE, M.S., Propagator.

CONSTANCE MANSFIELD GILMAN, Business Secretary.

SHIU-YING HU, Ph.D., Assistant in the Herbarium.

CLARENCE EMMEREN KOBUSKI, Ph.D., Curator of the Herbarium.

SUSAN DELANO MCKELVEY, A.B., Research Associate.

LILY MAY PERRY, Ph.D., Botanist.

LAZELLA SCHWARTEN, Librarian.

FRANS VERDOORN, Ph.D., Research Associate.

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